This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

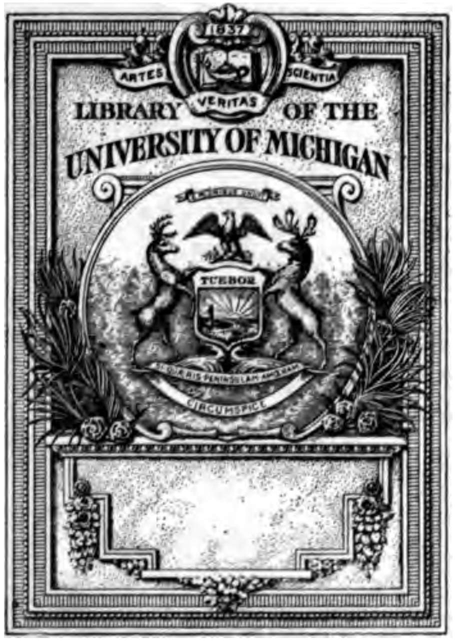
Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

A 463454

Y ACTIVITY PRO

[illegible]

THE MANUAL ARTS


1837
ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
E PLURIBUS UNUM
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE

BOY ACTIVITY PROJECTS

By SAMUEL A. BLACKBURN, B. E.
Department of Manual Training, North Texas State Normal College
Denton, Texas, and Author of Problems in
Farm Woodwork.

THE MANUAL ARTS PRESS
PEORIA, ILLINOIS

COPYRIGHT. 1918
SAMUEL A. BLACKBURN

PREFACE

IT has seemed to the author that the strong movement towards vocational education has placed before our teachers the need for including practical carpentry in the courses in manual training. The cabinets and smaller articles which are serving a very definite purpose, need to be complemented by some of the problems which afford work in practical carpentry.

An earlier book, *Problems in Farm Woodwork,* presents problems in practical carpentry which relate directly to farm work and rural life. Realizing that the boys in the towns and cities need the same training, the author has collected problems which will appeal to the interest of those boys, altho there are many things which will also appeal to the boy on the farm.

In getting together these problems the author has tried to keep the boy's welfare and interest definitely in mind, the articles relating almost entirely to the world of play, recreation, and physical development. Some of the problems will be made by the boy for his own use, but a part are adaptable as class problems, and will be used by the school students and patrons.

Many schools which have little or no apparatus for the exercise and play of the boys can well afford the equipment when it is made by the boys in the woodworking classes. Those boys who have wished to have gymnasium apparatus in their homes, but who have not been able to pay the high prices which such articles command, may with little expense make their own apparatus as satisfactorily as any that may be bought.

The amount of lumber and other material used has been planned economically, only commercial sizes of lumber being used, yet care has been taken to make each article as strong as its particular purpose demands.

—S. A. Blackburn.

329692

TABLE OF CONTENTS

I. THE OUTDOOR GYMNASIUM. PLATE

Outdoor Parallel Bars 1
Outdoor Horizontal Bar 2
Hurdles (high and low) 3
Standards for Jumping and Pole Vaulting 4
Basket Ball Standards 5
Judge's Stand for Tennis 6
Baseball Bats (three types) 7
Box for Baseball Goods 8
Toe Board 9
Home Plate 9
Frame for Tackling Dummy 10
Knockdown Portable Bleachers 11
Permanent Bleachers 12
Players' Bench 13
Bicycle Rack 13
Spring Board 14

II. INDOOR GYMNASIUM APPARATUS.

Indoor Parallel Bars 15
Chest Weights 16
Overhead Weights 17
Twisting Rod or Grip Bar 18
Punching Bag Frame 19
Ladder for Gymnasium 20
Indian Club 21
Dumb-Bell 21
Lockers for School and Club Gymnasium 22
Lockers for Club or Team Room 23
Bicycle Racks 24

III. PLAY.

Giant Slide 25
Teeter Board and Horse 26
Circle Swing or Revolving Ladder 27
Frame for Swing 28
Boy's Coaster 29
Stilts (two types) 30
Scoot .
Child's
Boomer
Slung S
Bow an
Whip B
Throw
Skees (
Skee Sl
Tobogg
Bob Sle
Children
Children
Children

IV. CAMPING.

Camp B
Folding
Folding
Camp C
Camp C
Punt ..

V. THE BOY SC

Insect
Spreadi
Plant P
Box Tr
Squirrel
Swallow

VI. PROBLEMS FO

Rabbit
Squirr
Bantam
Pigeon
Dog Ke

PLATE

.............................55
.............................56
.............................57
.............................58
.............................58

s.
.............................59

PLATE
Aerial 60
High Tension Condenser.............................61
Detector 61
Lightening Switch 61
Oscillation Transformer 62
Tuner 63
Aerial Switch 64
Hook Up of Wireless Station..................... .64

BOY ACTIVITY

OUTDOOR AND INDOOR GYMNASIUM APPARATUS.

The problems in these two groups will fill the needs of schools, and individuals interested in outdoor athletics and in physical training. Many of the problems are necessities, if athletics are to be of value to the school and students, while others in the groups will add to the conveniences and comfort of the participants and the onlookers. Nearly all of the problems afford ample work in actual carpentry, while the baseball bats, indian clubs and dumb bells require extremely careful and exact work in wood-turning. Little need be said of the physical value of the outdoor games, for everyone knows the good derived from them.

However, the very great benefits derived from indoor apparatus may well be enlarged upon here. We all know that exercise is necessary in order that the organs of the body may function properly. Yet how many people take no exercise except a little daily walking, which is often leisurely, and which does not augment deep breathing or improve the blood circulation. Appetites are poor, the food is poorly digested and poorly assimilated, encouraging anemia. There is a lack of reserve energy and a general condition of being below par. Headaches come on, often from no other cause; colds attack the body, and the individual comes out after the winter is over, anemic and nervous and possessed with what he calls biliousness and

OUTDOOR PARALLEL BARS.

These parallel bars are designed for a playground or outdoor gymnasium, for boys from the ages of ten to fourteen. For older boys the bars should be about 6″ higher from the ground. The ordinary gymnasium parallel bar is expensive and usually out of reach of boys who would wish to have one. The cost of material for this bar is about $2. It is made almost entirely of studding. The lower part is buried 18″ below the surface of the ground to give stability. With a very small amount of material and at a very small cost, a pair of parallel bars may be constructed that is serviceable on any school ground or in the home playground.

Material. Yellow Pine.
Three pieces 1¾"x3½"x8′.
Three pieces 1¾"x3½"x12′.
One piece 1¾"x3½"x14′
One piece ⅞"x8"x16′.
Some 8d, 10d, and 16d common nails.

Bill of Stock. Finished dimensions.
(1) Two pieces 1¾"x3½"x7′6" for bars.
(2) Four pieces 1¾"x3½"x5′10¾" for uprights.
(3) Two pieces 1¾"x3½"x6′3½" for lower lengthwise braces.
(4) Four pieces 1¾"x3½"x24" for end crosspieces.
(5) Four pieces 1¾"x3½"x2′6" for side braces.
(6) Two pieces ⅞"x8"x7′6" for floor.

Tools. Saw, square, draw knife, chisel, plane, pencil, wood file, and hammer.

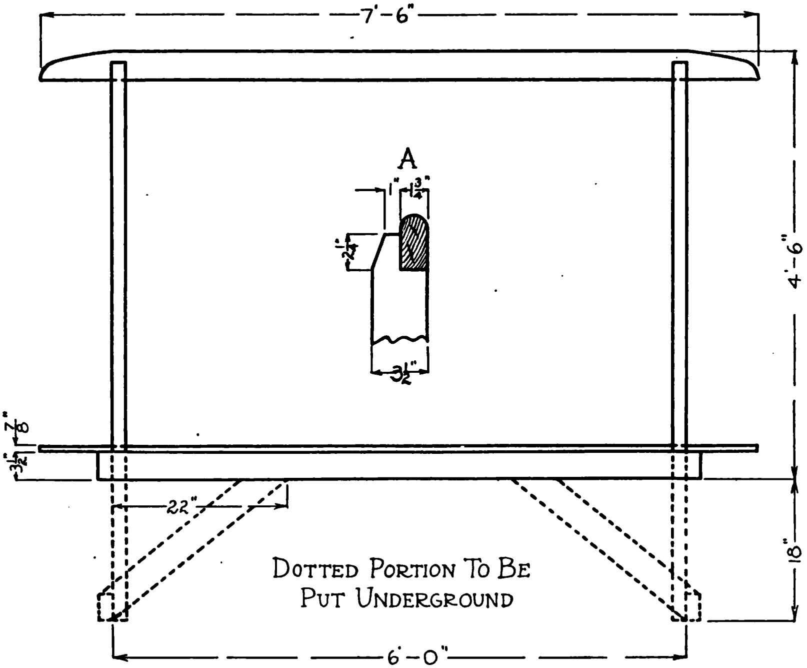
Working Directions. Cut all pieces except No. 5 to dimensions given in the bill of stock. To shape the ends of the parallel bars, lay out and cut, on a piece of paper 9″ long and the width of the studding, the shape desired for the ends of the bars. Lay this paper on the bar ends; draw outline, and with a draw knife and plane work down to the line. On the ends of each bar, and on the edge you wish to place on top, draw a semicircle with ⅞″ radius. Plane exactly as you would plane a cylinder, first planing off the corners, then each succeeding corner until you have completed a semicircle. File and sand perfectly smooth.

Lay off one end of each of the uprights as shown in detail *A*. Saw, chisel, and plane to the lines. Lay two uprights on the floor 17″ apart and nail on a crosspiece at the bottom. Measure up 18″ and nail on another crosspiece. Nail the opposite uprights in the same manner. Now, nail on the lower lengthwise braces, then place and nail the bars in position. Be very sure to make joint *A* strong and stable.

Lay off and cut the upper angle of the side braces, using 9″ on one arm of the square and 11″ on the other arm. (See illustration, Plate 2.) Measure in 22″ from the outer edge and nail the brace to the lengthwise piece. Before nailing the lower end make sure that the uprights are plumb in every way. Nail on the braces, then saw off the extending corners. Saw and nail on the floor. Do not spare nails in any of this work, since all joints must bear considerable strain.

Paint the underground part of the bars with creosote or coal tar to preserve the wood, and paint the part above ground a moss green to harmonize with the outdoor surroundings.

OUTDOOR PARALLEL BARS



DOTTED PORTION TO BE PUT UNDERGROUND

OUTDOOR HORIZONTAL BAR.

Every boy knows plenty of uses for a horizontal bar, and every boy should have free and constant access to one. Boys and men who have little exercise need it for that purpose, and those who do have plenty of heavy work need it just as much for the quicker motions which keep the body limbered and free in movement.

Material.

Two pieces 2"x6"x8' yellow pine.
Seven pieces 2"x4"x8' yellow pine.
One piece 2"x4"x5' yellow pine.
One piece 2"x2"x5' hickory, ash, or birch.
Two ⅜"x8" bolts or dowels.
A number of 16d nails.

Bill of Stock.

Two pieces 1¾"x5½"x8' for standards.
Two pieces 1¾"x3½"x8' for base.
Four pieces 1¾"x3½"x5'3½" for braces.
Four pieces 1¾"x3½"x2'6" for braces.
Two pieces 1¾"x3½"x5' for braces.
Six pieces 1¾"x3½"x14" for stakes.
One piece 2"x2"x5' for rod.

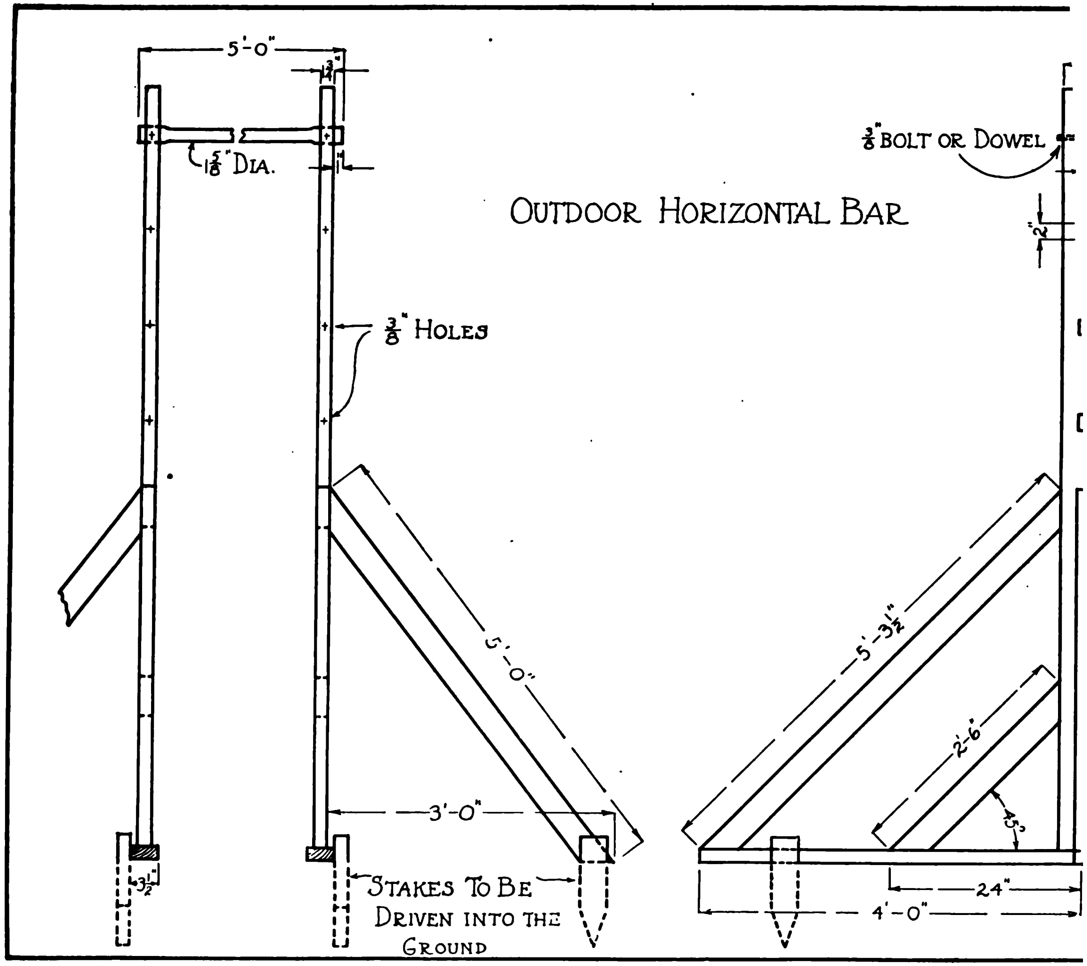
Tools. Saw, plane, framing square, knife, rule, hand-ax, brace, ⅜" bit, pencil gage, level, spokeshave, and hammer.

Working Directions. In sawing the braces the two 5' side braces are sawed from the 10' piece. The stakes are all sawed from an 8' piece. One 5'3½" and one 2'6" piece are sawed from an 8' piece. The braces (except the 5' side braces) are cut at a 45 degree angle. The long dimensions are given in each case. Measuring with equal numbers on the square will give an angle of 45 degrees. (See illustration in the drawing.) Cut the two 5' braces with an angle of 4 to 3 degrees. Saw the stakes into pieces 14" long and sharpen with hand-ax.

Square up the ends of the 2x6's to exactly 8'. To mark the square openings for the bar, begin at one end, measure down 6" and draw a line across. Then add 12" three times and draw lines across. With a pencil gage draw a line down through the middle of the 2x6, crossing these four lines just drawn. Now with the rule, square and pencil, measure and draw lines across, 1" above and 1" below each cross line; then 1" on each side of the middle line. If you feel that you are a good workman this marking will suffice, and you may begin to chisel out the opening. A sure way to get this is to run the cross lines around and mark on both sides, being sure to use the same edge while marking. The other 2x6 is handled in the same way. Now lay off and bore a center hole thru the standards at each opening just made, for the ⅜" bolt or dowel. This, as you will notice from the drawing, goes thru the wide part of the plank. Do not try to bore thru the entire distance from one side, but bore from both sides. Use a great deal of care to get the holes straight thru, as the dowel will cause trouble if it is crooked.

Shave down the turning rod. This will necessarily be a modeling job since both ends are to be left square so as to fit well into the openings made in the uprights. The rest of the rod is rounded. Make the ends small enough so that they will slide easily into each hole.

The assembling of this is very easy. Mark off the middle of the two 8' base pieces and drive some spikes up thru into the 2x6. Then nail on the braces. Use 16d nails thru the entire project. Place the bar in position. Stand up both standards and put the bar in the top holes. Take the actual measurements on a 5' stick, then spread the base to exactly these dimensions and tack the standards on temporarily. Level off the ground under the base pieces, using a level to test it with. When both bases are level, apply



OUTDOOR HORIZONTAL BAR

the level to the uprights to get them plumb. Now drive in the stakes in the places as shown in the drawing, and nail solid. Remove the lower temporary crosspiece and you have completed a good, serviceable, outdoor, horizontal bar.

A good coat of paint should be added to correspond to the general scheme carried on about the place.

HIGH AND LOW HURDLES.

The low hurdle is more often used by boys of high school age, while hurdles of both heights are used in college track meets. Either kind must be the standard height, and must be made to stand firm. They must also be light enough to be knocked over rather easily, so as not to interfere with the stride of the runner who may happen to trip on one while running.

The hurdle given here is a combination low hurdle with a high hurdle attachment which may be put on and off quickly. The attachment slides over the top crosspiece, on the inside of the uprights, and fits snugly in position, the 3" piece of wood forming a rest which keeps it in place. The design given here is one of the very simplest that can be made. It is light in weight and inexpensive.

Material. White Pine.

Lower hurdle.
- One piece 1¾"x3½"x20".
- One piece ¾"x10"x2'6".

Upper hurdle.
- One piece ¾"x5"x2'6".
- Some 1½" finishing nails.

Bill of Stock. Finished dimensions.

Low hurdle.
- (1) Two pieces 1¾"x3½"x10" for base.
- (2) Two pieces ¾"x2"x2'6" for uprights.
- (3) Two pieces ¾"x1¼"x2'6" for lower crosspieces.
- (4) One piece ¾"x1½"x2'6" for upper crosspieces.

High hurdle.
- One piece ¾"x1½"x2'6" for upper crosspiece.
- Four pieces ¾"x1½"x13½" for uprights.
- Two pieces ¾"x1½"x3" for block between uprights.

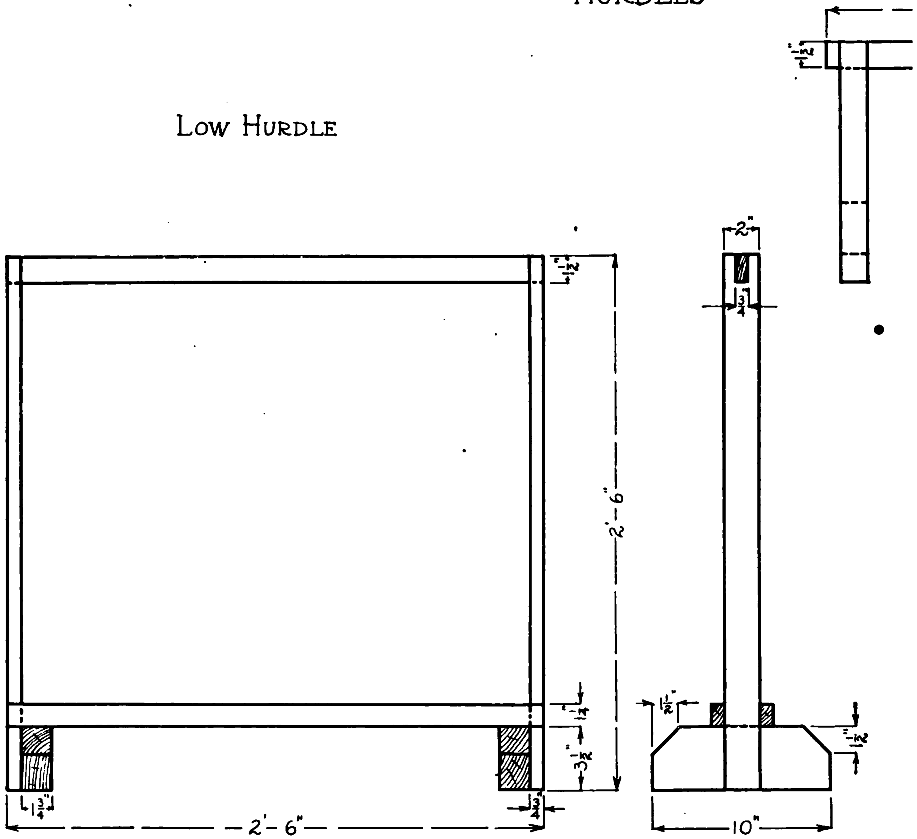
Tools. Saws, plane, gage, try-square, chisel, pencil, rule, and hammer.

Working Directions. Make the base pieces first. Lay off, saw and plane the corners according to the drawing. Rip out the remaining pieces, gage and plane to dimensions given in the bill of stock. In the end of each upright, No. 2 in bill of stock, lay off a joint ¾" wide and 1½" long; saw to line lengthwise and chisel out the wood, making it so that the upper crosspiece will fit tightly into the joint.

In making the high hurdle attachment cut all pieces to dimensions given in the bill of stock. Nail the uprights to the base, then nail in the upper crosspiece, and the lower crosspieces. (If the wood is yellow pine care must be taken in driving nails, since it splits easily. Boring small holes helps to prevent splitting. Small sized nails may be used.)

HURDLES

LOW HURDLE



STANDARDS FOR JUMPING AND POLE VAULTING.

The standards given here may be used for pole vaulting and high jumping. The movable pin comes out, and is used in the pole box alone for distances less than 6′, the sliding pole being used only in pole vaulting. The design is one of the very best, since it is heavy at the bottom making it stand firm. The four blocks screwed on underneath the frame make the standards adjustable to any unevenness of the ground. The sliding inner pole can be raised to any desired height. The pole being light, the added height does not make the standard top-heavy.

Material.

One piece 1¾"x3½"x10′.
One piece 1¾"x1¾"x6′.
One piece ¾"x10"x6′.

Bill of Stock. (For one standard. Two are needed.)

Two pieces 1¾"x3½"x2′8" for base.
Four pieces 1¾"x3½"x4" for feet.
Four pieces 1¾"x1¾"x19" for braces.
Two pieces ¾"x2¾"x5′8 5/16" for box pole.
Two pieces ¾"x1¼"x5′8 5/16" for box pole.
One piece 13/16"x13/16"x5′10½" for sliding pole.

Tools. Saws, plane, chisel, wood file, brace, 1″ and ⅜″ bits, rule, T-bevel, gage, compass and hammer.

Working Directions. Make the lower framework of the standards of two pieces of studding 2′ 8″ long, cross-lapped at the center. Screw blocks of studding underneath as shown in the drawing. These blocks or feet enable the standards to stand easily and more firm on uneven ground. Bore a 1″ hole thru this joint. This is merely an extra precaution, affording room to loosen the inner sliding pole in case it should stick from twisting, warping or swelling of the lumber.

Now make the long box pole thru which the inner pole is to slide. This is shown in the detail, "Cross-Section Thru *A*." Make this box pole longer than the directions call for, since the studding in the lower framework may be a trifle narrow, making the pole of lesser height than you wish. In nailing this box pole together be very careful that the nails are not driven too close to the inside, so as to protrude in the inner opening, or split and push the wood into the opening where the inner pole is to slide. Make the inner sliding pole so that it slides easily up and down inside the box pole.

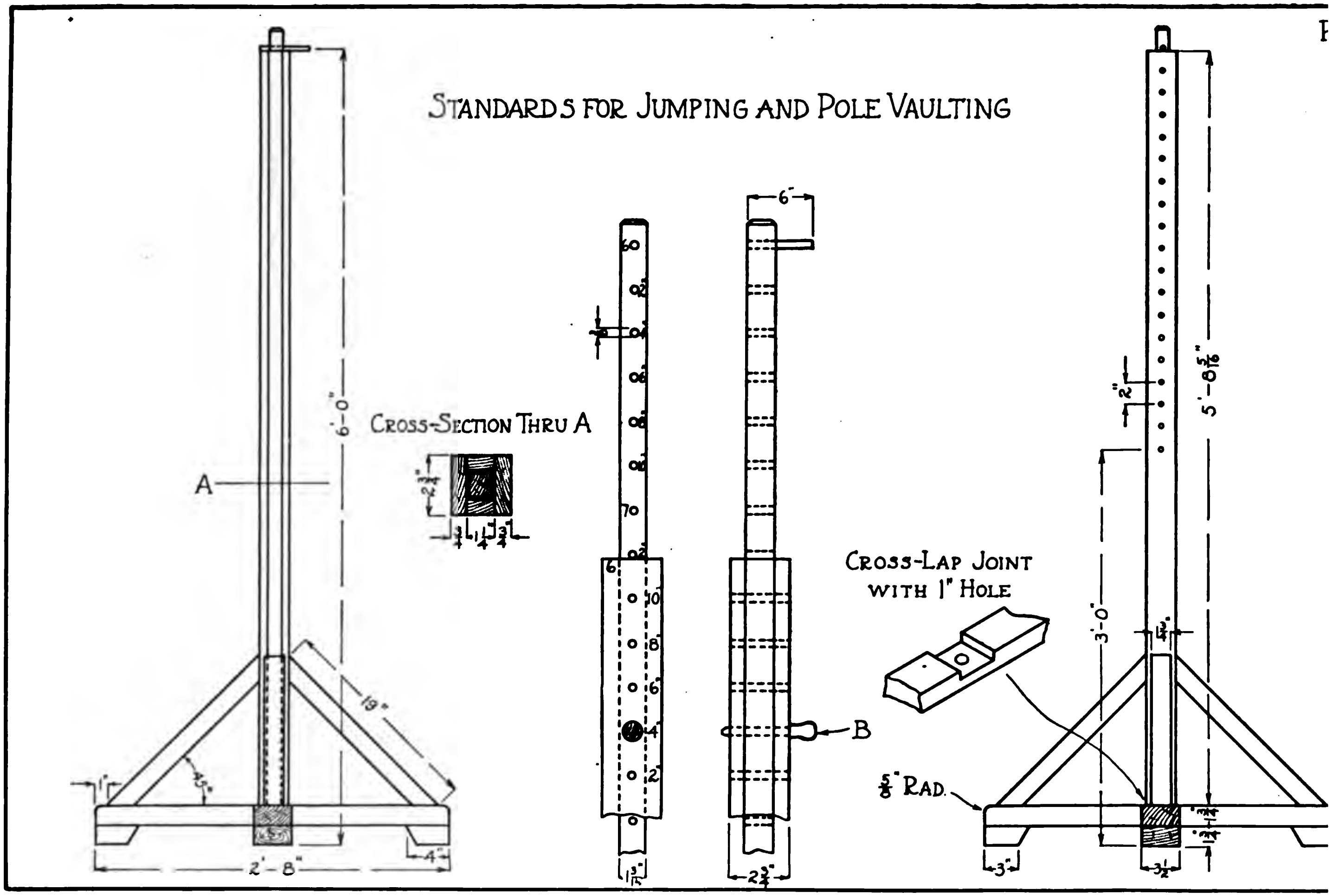
Square one end of the box pole; measure the proper length and saw. Toenail this box to the lower frame, again being careful to keep the inner opening free from nail points or pieces of split wood. Miter the braces at each end and nail them on, being very careful to keep the upright pole in plumb.

Now lay off the positions for the holes in the box pole of the standard. These holes are 2″ apart. Lay off the centers for the holes on one side, and with a try-square run the lines around to the opposite side. With a ⅜″ bit bore these holes, working from both sides.

Lay off the sliding pole in the same way, leaving about 2″ at the top to use as a handle. Be very careful to bore these holes thru straight. The pin, B, holds the sliding pole in position.

The figures on the box pole read upward, but the figures on the inner sliding pole must read downward. The right hand figures indicate inches, while the left hand figures indicate feet. The detail shows the standards set at 7′ 2″.

A pin may be turned out on a lathe, altho a ⅜″ dowel pin will serve the purpose as well.


STANDARDS FOR JUMPING AND POLE VAULTING

ALL STANDARD

re built of many sizes and pro- [illegible] the height of the basket. [illegible] the only arbitrary or fixed [illegible] given here is the neatest, the [illegible] the most satisfactory one the

aterial.
[illegible] pole.
[illegible]
[illegible] flooring.
[illegible]
[illegible]
[illegible] 8d casing nails.

Dimensions
[illegible] pole.
[illegible] lower boards.
[illegible] side boards.
[illegible] middle board.
[illegible] flooring.

ainting square [illegible]
[illegible]

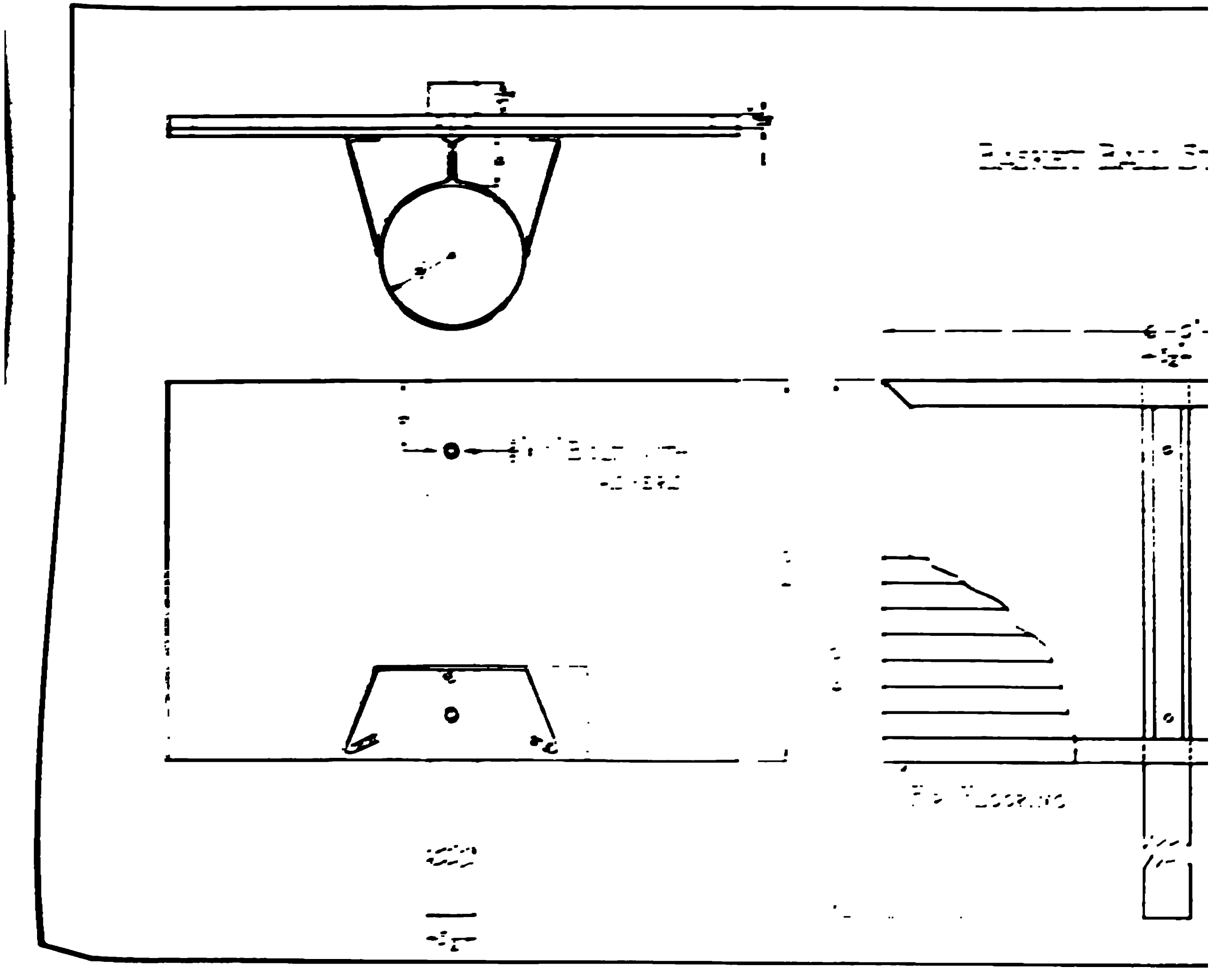
[illegible]

The upper and lower ones are [illegible] long and the sides 4'. These are cut at an angle of 45° at each end. Nail these together with [illegible] nails. Cut the middle piece to fit and toe-nail onto the middle of the frame. Plane off the groove from one piece of flooring and nail it on evenly. Continue with the remaining pieces of flooring until all are nailed on. Saw and plane off the extra amount if there is any. [illegible] bore two holes thru the flooring and studding beneath, one [illegible] from the upper end and the other [illegible] from the lower end. Place the frame over the [illegible] and mark the places for the bolts thru the holes already made. Remove the frame, bore the holes, and put in the bolts.

Dig a hole 3' deep, and after the pole has been set in the hole [illegible] mixture to give it a larger, [illegible] the end of the pole.

The whole frame should be painted a color which does not [illegible] very much. If more shut in, white [illegible] very easily but it aids in [illegible] a dark spot.

The [illegible] usually bought, but there is no reason why these can not be made in the large shop, even [illegible] more substantial than the ordinary factory made ones.


BASKET BALL S
FIN FLOORING

BASKET BALL STANDARD.

Basket ball standards are built of many sizes and proportions, and after several designs, the height of the basket, 10′ from the ground, being the only arbitrary or fixed measurement. The standard given here is the neatest, the best built, and on the whole the most satisfactory one the author has yet seen.

Material. For one standard.

- One piece 4″x6″x16′ for pole.
- Two pieces 1¾″x3½″x12′.
- Seven pieces ¾″x4″x12′ flooring.
- Two bolts with washers ⅝″x7″.
- One goal with bolts, etc.
- Some 16d common and 8d casing nails.

Bill of Stock. Finished dimensions.

- One piece 3½″x5½″x16′ for pole.
- Two pieces 1¾″x3½″x6′ for lower border.
- Two pieces 1¾″x3½″x4′ for side border.
- One piece 1¾″x3½″x3′5″ for middle brace.
- Fourteen pieces ¾″x4″x6′ flooring.

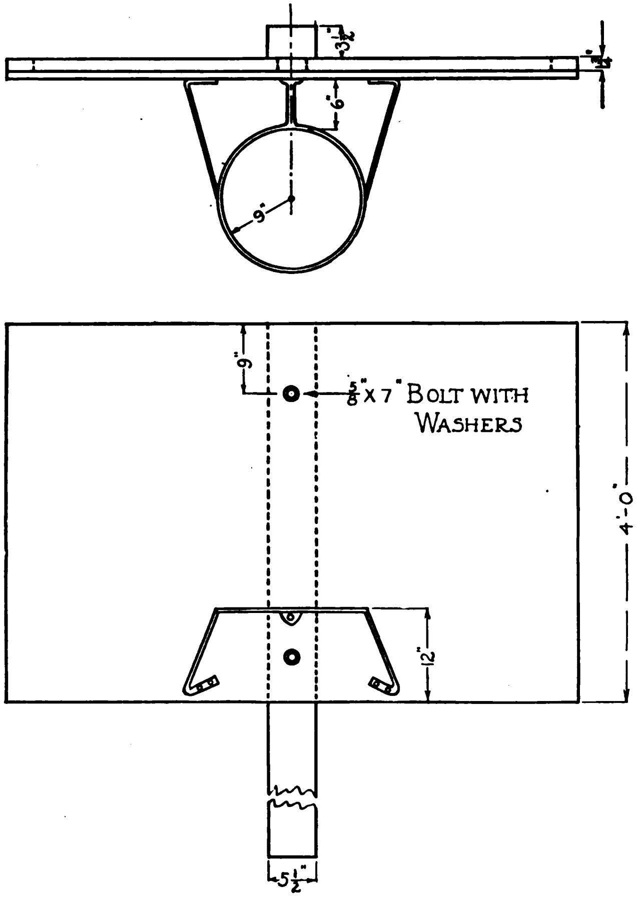
Tools. Saws, plane, framing square, brace, ⅝″ bit, hammer, and smaller bits for putting on goal.

Working Directions. Make the frame from 2x4's first. The upper and lower ones are 6′ long and the sides 4′. These are cut at an angle of 45° at each end. Nail these together with 16d nails. Cut the middle piece to fit and toenail onto the middle of the frame. Plane off the groove from one 6′ piece of flooring and nail it on evenly. Continue with the remaining pieces of flooring until all are nailed on. Saw and plane off the extra amount if there is any. In the center piece bore two holes thru the flooring and studding beneath, one 9″ from the upper end and the other 6″ from the lower end. Place the frame over the 4x6 and mark the places for the bolts thru the holes already made. Remove the frame, bore the holes, and put in the bolts.

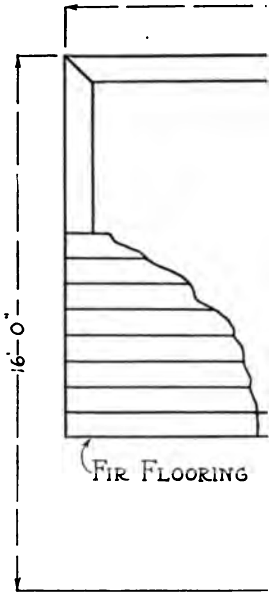
Dig a hole 3′ deep, and after the pole has been set in the hole, fill with a concrete mixture to give it a larger, heavier base and to preserve the end of the pole.

The whole frame should be painted a color which does not blind the eyes, if in an open place. If more shut in, white is best. White gets dirty very easily but it aids in detecting the basket if in a dark spot.

The goals are more usually bought, but there is no reason why these can not be made in the forge shop, even better and more substantial than the ordinary factory made ones.



BASKET



JUDGE'S STAND FOR TENNIS.

This stand is made especially for matched games in tennis. The judge should be up above the net and look down on the court in order to judge more easily. The problem in this case is to make a chair or stand high enough and at the same time firm and strong enough without using too much wood. The only kinds of material used here are 2x4's and 1x4's and the problem merely resolves itself to a measuring, marking, sawing and assembling, touching up the ends of pieces in a few places with a plane.

Material. Yellow pine surfaced on all sides.

Three pieces 1¾"x3½"x12'.
One piece 1¾"x3½"x10'.
Three pieces ⅞"x3½"x14'.
Two bolts ⅜"x4".

Bill of Stock.

(1) Two pieces 1¾"x3½"x8' for legs.
(2) Two pieces 1¾"x3½"x5'7" for legs.
(3) Two pieces 1¾"x3½"x5'4" for base.
(4) Two pieces 1¾"x3½"x13" for supports of seat.
(5) Two pieces 1¾"x3½"x20" for support to footrest
(6) Four pieces ⅞"x3½"x2'2" for seat.
(7) Three pieces ⅞"x3½"x2'2" for footrest.
(8) Five pieces ⅞"x3½"x2'2" for back.
(9) Two pieces ⅞"x3½"x24" for front steps.
(10) Two pieces ⅞"x3½"x4'6" for braces at back.

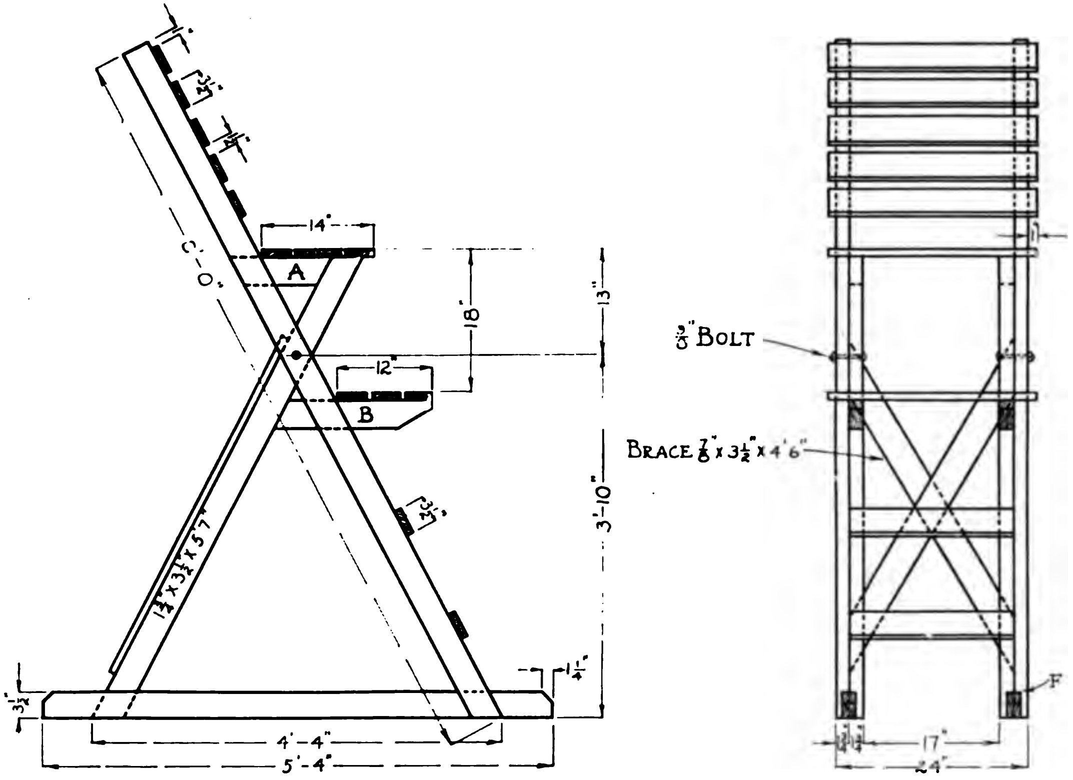
Tools. Saws, plane, square, try-square, rule, chisel, brace, ⅜" bit, T-bevel, and hammer.

Working Directions. Set the T-bevel at an angle of 3¼" to 6¼" as shown on Plate 2. With this angle you can mark the lower ends of the legs and also the angles for both the footrest and seat. Lay off an end of each of the four legs, and saw. Lay the legs down on the floor with the lower edges 4'4" apart, and place them across each other so that the edges will cross 3'10" from the base. Measure up 13" further, and with the T-bevel mark the line at which to saw the upper end of the back leg. While in this crossed position bore the center hole for the bolt. With these legs as patterns, cut two others for the opposite side. At the bottom end of the legs a base piece, 1¾"x3½", is attached, ⅞" being sawed and chiseled out of the inside of each of the legs in order to allow the base piece to slip thru as shown at *F* in the drawing. Nail this base piece in place and put the bolt in. Saw out pieces *A* and *B*, Nos. 4 and 5 in bill of stock, and nail them in place, sawing off the lower corner of piece *B* as shown in the drawing.

Saw the braces for the back and make a cross-lap joint where they cross. Nail on the braces. Nail on the two lower pieces for steps being careful to space them evenly. Nail on the boards for the footrest and seat and finally the back pieces, placing them as shown in the drawing.

Give the stand two good coats of green paint to harmonize with the out of doors.

JUDGE'S STAND FOR TENNIS



BATS.

shown on this plate, a reg-
bat and a bat used for

aight grained and without

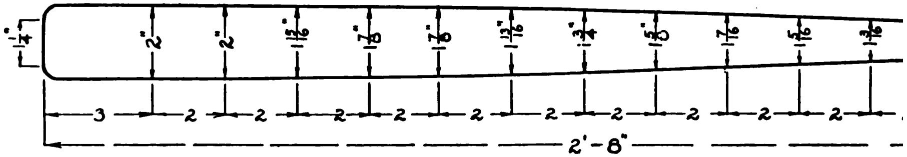
or indoor bat.
r mushroom bat.

One piece 2⅛"x2⅛"x3'1" for baseball bat.

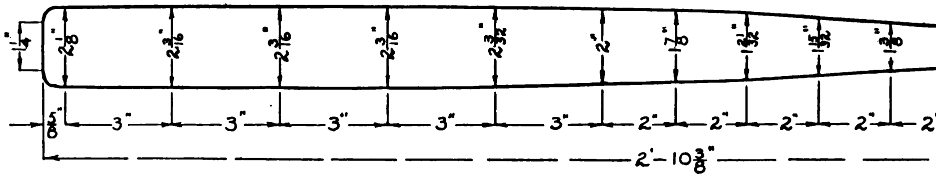
Tools. Lathe and tools.

Working Directions. Rough down almost to dimensions with a gouge. Finish with a skew. Use the calipers to get the proper diameter in each case. No difficulty will be experienced if the drawings and dimensions are followed carefully.

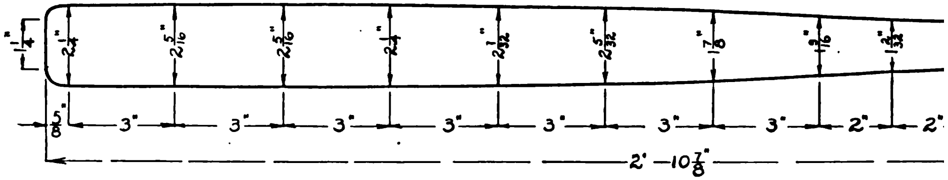
INDOOR BAT



MUSHROOM BAT



BASEBALL BAT



BOX FOR BASEBALL GOODS.

Every boy will see the advantage of a box made to hold the balls, gloves, masks and bats which have to be kept a part of the time at school. Usually these are left in some out of the way corner where they are often disturbed, and where they make an unsightly appearance. At night these things must be carried home, and often when the time comes for the coveted game, the boy remembers that his ball or bat or glove is somewhere else.

The box will afford a safe keeping place for all the balls, bats, and gloves that are likely to be brought to school. The balls and bats are slid thru the openings, but the masks and gloves are put in from the top. The key is kept by the leader or captain, or it is put in a place of its own.

Material.

One piece ¾"x14"x9'.
One piece ¾"x8"x14'.
One piece ½"x12"x4'.
One lock.
One pair 2" butt hinges.
Some 8d casing nails.

Bill of Stock. Finished dimensions.

Two pieces ¾"x16"x3'1½" for top and bottom.
Two pieces ¾"x12¾"x3'1½" for front and back.
Two pieces ¾"x1¾"x3'1½" for lid.
Two pieces ¾"x1¾"x14½" for lid.
Two pieces ¾"x12¾"x14½" for ends.
One piece ½"x12"x3' for partition.
One piece ½"x12"x9½" for partition.

Tools. Saws, plane, brace, extension bit, small drills, try-square, gage and hammer.

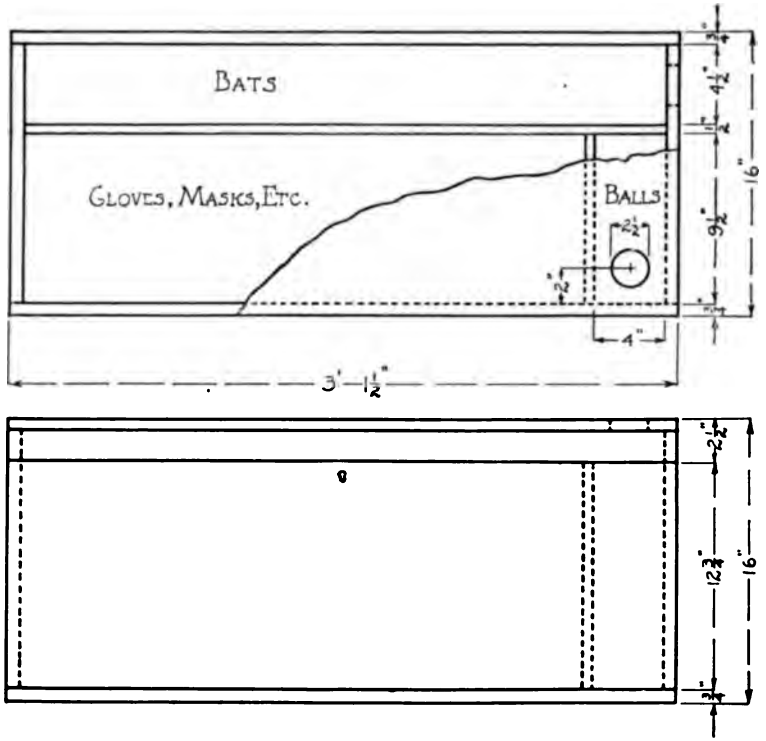
Working Directions. This case is a plain box, nailed tight on all sides, including the top. The top part is sawed off at a distance of 2½", forming the lid.

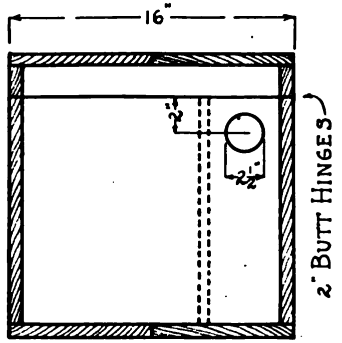
Saw the 8" board into lengths of about 3'3". This leaves plenty of room at the ends to allow for bad ends where joints are to be made. Glue two boards together for the top and bottom. Use the 14" board for the sides and ends. Cut two 3'1½" lengths for the sides, and two 14½" lengths for the ends. Nail these together. Then nail on the top and bottom forming a tight box. Now proceed to mark and saw off the top, forming a lid. Set the gage to 2½" and gage around the top, holding the head of the gage against the top board. Saw on this line, being careful to saw it straight so that very little finishing will be necessary. (Care should be taken in making the box to keep the nails out of the way where this sawing is to be done. More nails may be put in afterward.)

To make the long partition, take exact inner measurements of the box. Use ½" materials for this partition, and nail it in 4½" from one side. Saw and fit the crosswise partition. Bore a 2½" hole in the top for the balls to fall thru, and one in the right end 2" down from the top of the lower box. Put on the hinges and lock.

PLA

BOX FOR BASEBALL GOODS





TOE BOARD.

This piece of apparatus is used in track work. It is staked down just outside of the seven-foot circle used to stand in while throwing the discus and hammer and putting the shot. It is made in three layers to prevent twisting and warping, and the boards are arranged in a manner to prevent waste in sawing, and to form broken joints.

Material. Any old pieces of ⅞″ material. The top piece will look better if it is made of one piece. If economy is needed the following pieces may be used:

One piece ⅞″x8″x3′5″.
Three pieces ⅞″x5″x1′11″.
Two pieces ⅞″x4″x12″.
Some 8d common nails.

Tools. Saw, draw knife, hammer, brace, 1″ bit, large compass, framing square, and spokeshave.

Working Directions. Lay the 8″ board on the floor and drive a nail in each upper corner to hold it to the floor temporarily. With the framing square and pencil draw a line thru the middle crosswise, and extend this line to at least 4′ in length. Secure a piece of wood 4′ long or longer and about ½″ to 1″ thick to use as a compass. Bore a hole in one end to admit a pencil. Measure back 4″ and bore another hole. Measure from the center of this hole back 3′6″ and drive a nail or brad thru this point. Slide the pencil thru the end hole; place it on the outer edge of the 8″ board on the line drawn previously. Now drive the brad temporarily into the floor. Draw the outer line first. Then move the pencil and draw the inner line. Slide the compass stick around to the ends and use the stick as a straight edge to draw the lines *A* and *B*. Mark the places for the holes so that you will not put nails at these points. If there is a band saw in the shop it is an easy matter to cut to these lines. If not a saw, draw knife and spokeshave will soon take off the wood down to the lines.

Now make the second curved piece. Saw angles on the middle boards so that when the top board is laid over the two middle pieces placed together there is a complete curved piece the size of the top board just finished. Mark around with a pencil and saw down to the line as before.

The lower curved piece is composed of three boards. Saw the angles first and fit them together before laying off and sawing the circles. A good idea of the angles may be noticed in the drawing. Nail the three pieces together and finish off with a plane and spokeshave. Bore the 1″ holes at the places indicated. Give two coats of white paint.

HOME PLATE.

Most boys like to have a home plate that is of regulation size. The one here shown is made of two pieces of wood, the grain of the wood running opposite. This keeps the plate from warping and splitting.

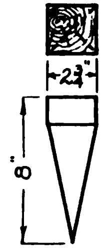
Material.

Two pieces ⅞″x18″x18″.
Three pieces 2¾″x2¾″x8″ for stakes.
One dozen 1½″ No. 9 flathead screws. Nails may be used and clinched on the under side.

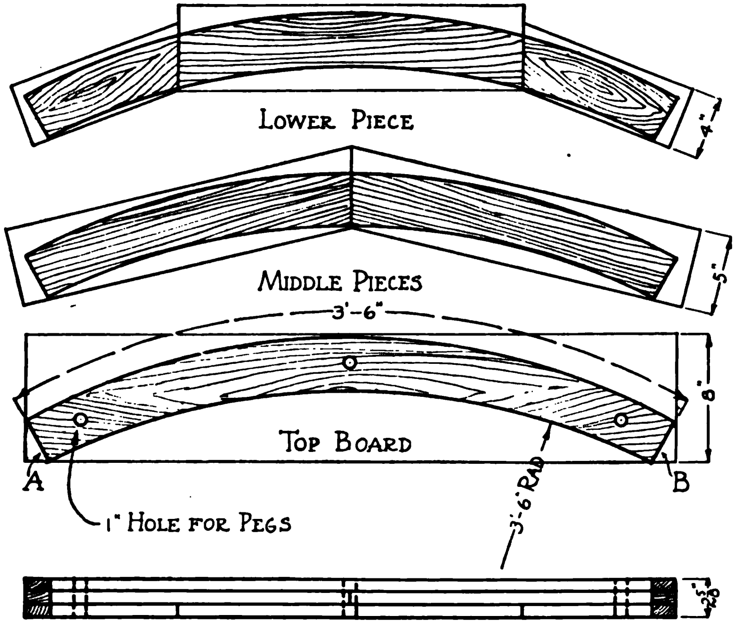
Tools. Saw, plane, framing square, brace, countersink, small bit for screws, screwdriver, hammer and hand-ax.

Working Directions. Square the two pieces to exactly 18″x18″. Locate a point in the middle of one end and in the middle of each edge. Connect these points and saw to the lines. Lay this piece down over the other piece so that the grain of the wood runs in the opposite direction; mark and saw. Plane the edges smooth. Put in the screws in about the positions shown in the drawing.

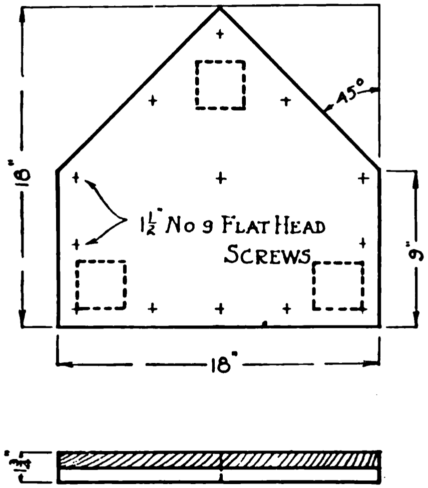
PLATE
MAKE 3



TOE BOARD



HOME PLATE



Make three stakes as shown in the upper right hand corner in the drawing. Saw the pieces to 8″ in length and point them with a hand-ax. They may be sawed and planed. Level off the ground where the plate is to be put permanently and drive in the three stakes, one towards the point and the other two at the outer corners as shown in the drawing. Lay the plate over the stakes and nail on with 16d nails.

FRAME FOR TACKLING DUMMY.

Every football team has ample use for a tackling dummy in the regular practice. Usually only the bigger teams have one. Manual training boys who are interested in athletics will be eager to make the frame for the tackling dummy, and it will prove a good practical problem.

Material. Finished dimensions.
Two pieces 3½"x3½"x16'.
Two pieces 1¾"x3½"x16'.
One piece 3½"x3½"x12'.
Two pulleys with 5½" wheel with eyebolts attached.
Two bolts ½"x7".
Twenty-eight feet of rope.
Some 16d and 20d common nails.

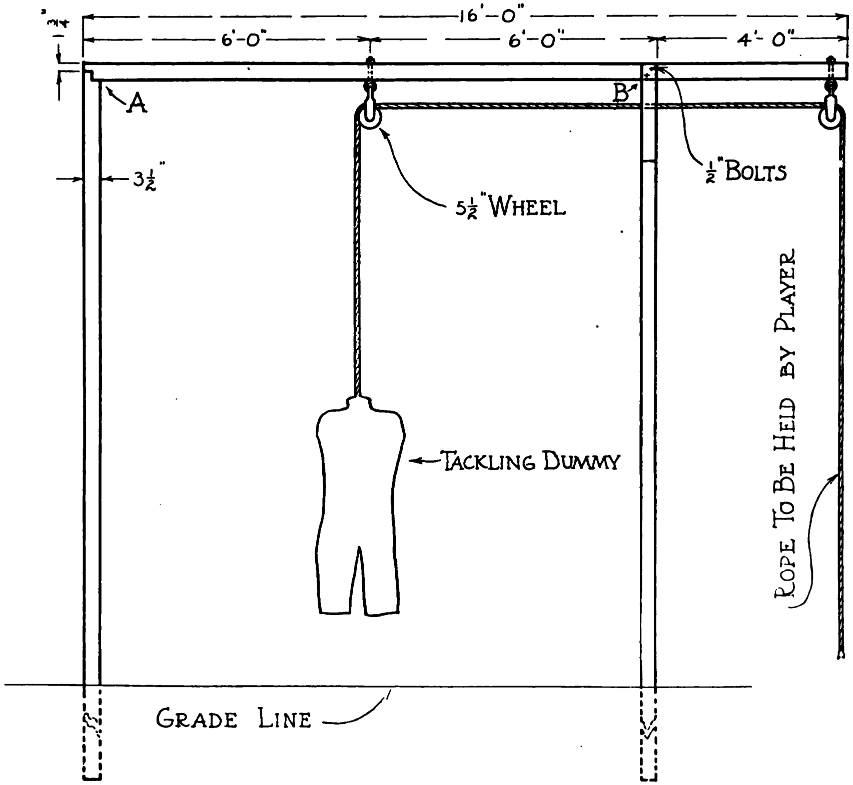
Tools. Saw, brace, ½" bit, bit for eyebolt hole, framing square and hammer.

Working Directions. A careful study of the drawing will show the construction of this problem, which consists of one upright 4x4, another upright 4x4 which has a longer 2x4 spiked on each side, and a horizontal 4x4 which holds the pulleys.

First, spike the two 2x4's onto the 12' long 4x4. Saw a joint in one end of each of the other 4x4's to make the joint at *A*. This allows spikes to be driven into the end of each scantling, giving double strength. Before nailing together, bore the holes and put in the eyebolts for the pulleys. Nail together joint *A*, slip the horizontal 4x4 into the opening in the other upright. and put in two bolts as at *B*. Set the posts 3' deep in the ground. If the frame is to remain permanently, pour concrete into the post hole.

The more common method of using a tackling dummy is to use one pulley, the coach or player grasping the end of the rope and forcibly holding it while the player tackles the dummy. This is rather strenuous exercise for the coach. The addition of a second pulley as shown here gives the coach a much easier job since he has a chance to use his weight straight down when the dummy is tackled. He is also able to regulate this weight. Another method is to hang a bag of sand to the end of the rope. This does not take into consideration the differences in weight of the players, hence does not serve so well.

FRAME FOR TACKLING DUMMY



[illegible] marked [illegible] are spiked to the tops of [illegible] and [illegible]. Holes are bored thru the middle between the upright pieces as at [illegible] for bolts to hold the seat boards. The seat boards are [illegible] long, which means that the joints should alternate. When two boards come together the holes will have to be bored a little to one side of the center so that they will not come in the joint. You will see this for yourself when you are ready to put on the seat boards.

PERMANENT BLEACHERS.

The bleachers given here are designed to be permanent [illegible]. They are made with as little material, and with as little work as possible. They are substantial and as comfortable as any bleachers of this type. In communities where the bleachers are used only a few times in the year, the seat boards are not nailed on permanently. When the bleachers are to be used, lumber can be rented for a short time at a small cost. This plan is more economical in some circumstances.

Material

- [illegible] for carriages
- [illegible] for seats
- Three cedar posts [illegible] long.
- [illegible] for braces
- [illegible] for foot rests
- [illegible] for short pieces under seat boards
- Some sand and cement
- [illegible] with washers
- [illegible] and [illegible] nails.

Tools [illegible] hand-ax, [illegible] and hammer.

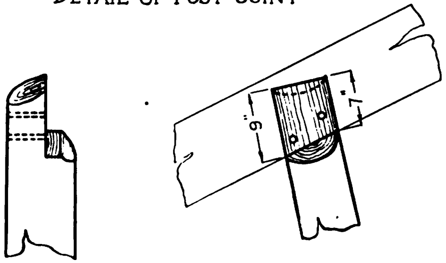
Working Directions [illegible] at the beginning is [illegible] the post and carriage pieces bolted to it at the proper angle. First saw off the lower part of the carriage as shown in the drawing. On the upper end of each post, measure down, as nearly as possible, 7" on one side and 9" on the other, and saw to this angle as shown in the detail. Saw in about 3½" and with the hand-ax split out the piece and cut down smoothly. Measure down about 14" on the carriage piece and lay the post across. Bore two holes thru both post and carriage and put in bolts. Treat the three others in the same way. When these are bolted together your next task is to dig the holes for the posts, and scoop out a shallow hole for the front rests. Lower all the posts into the holes. Throw some small stones into the bottom of the holes and also into the shallows in the front until you have levelled up the three carriages so that the seat boards will be level. Point *A* is 6'6" high, and point *B* is even with the grade line. Nail on some braces, stakes, etc., to hold the carriages in position temporarily while filling in the concrete mixture. Make a fine mixture first so that it will run down into the gravel already placed in the holes to cement them together; then ordinary concrete until the holes have been filled flush with the grade line. It will be better at this time to allow the concrete to harden at least over night before going on with the work.

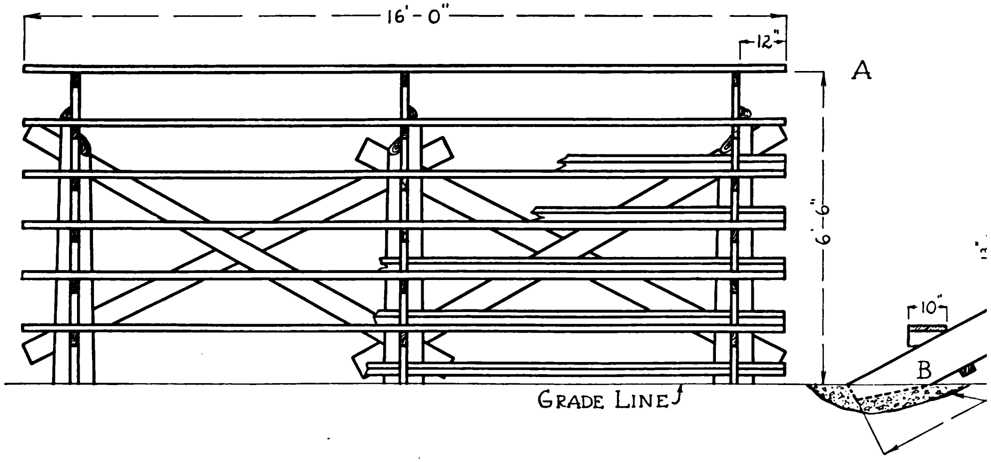
Saw out the short pieces of 2x4 that are to fit under the seat boards, laying them off so that one diagonal sawing will do for two pieces thus saving work and material. Lay off and nail on these pieces in the positions shown in the drawing, beginning at the top and measuring down 2'4" each time. The footrests on the bottom are also 2'4" apart. These may be easily seen by referring to the drawing. These footrests are spiked on permanently.

Nail the braces onto the posts as shown in the drawing. The seat boards may be nailed on permanently, or left loose as desired, to meet local conditions.

PERMANENT

Detail of Post Joint





PLAYERS' BENCH.

This is an easily constructed bench, strong, durable and convenient. It is designed for players' use at a baseball game, altho it may be used for many other purposes quite as well.

Material. Yellow pine.
One piece 1¼"x12"x10'.
One piece 1¼"x10"x2'5".
One piece 1¼"x3½"x18'.
Some 10d and 16d common nails.

Bill of Stock. Finished dimensions.
One piece 1¼"x12"x10' for seat.
One piece 1¼"x3½"x8'8½" for middle brace.
Two pieces 1¼"x3½"x2'1" for braces.
Two pieces 1¼"x3½"x24" for bases.
Two pieces 1¼"x10"x14¼" for uprights.

Tools. Saws, hammer, square, rule and T-bevel.

Working Directions. Saw all pieces to lengths mentioned in the bill of stock. Set the T-bevel at an angle of 2" to 1" and then the reverse, to get the angles at *A* and *B*. Saw these angles. Draw a line parallel to *A* at *C*, 3½" down, and saw out a notch 2⅝" deep so that the corner braces fit over the lengthwise brace. Nail the base pieces to the uprights using 16d nails. Then nail the middle brace between the uprights, put in the corner braces and nail on the top. Do not spare nails since this bench must be made strong.

BICYCLE RACK.

This is a plain rack, easily constructed, and it serves the purpose admirably. The wheels are backed into the openings. The rack may be used at schools where boys and girls ride to school on bicycles, at club houses, Boy Scout headquarters, or any place where a number of wheels are likely to be left.

Material. Yellow pine.
Two pieces 1¾"x3½"x10'.
Three pieces 1¾"x3½"x14'.
Some 10d and 16d finishing nails.

Bill of Stock. Finished dimensions.
(1) Three pieces 1¾"x3½"x9'8½" for upper and lower parts of frame.
(2) Two pieces 1¾"x3½"x22" for lower part of frame.
(3) Two pieces 1¾"x3½"x23¾" for upper part of frame.
(4) Two pieces 1¾"x3½"x3' for end braces.
(5) Two pieces 1¾"x1¾"x2'9½" for inside back braces.
(6) Sixteen pieces 1¾"x1¾"x3' for supports for bicycles.

Tools. Saws, plane, square, pencil and hammer.

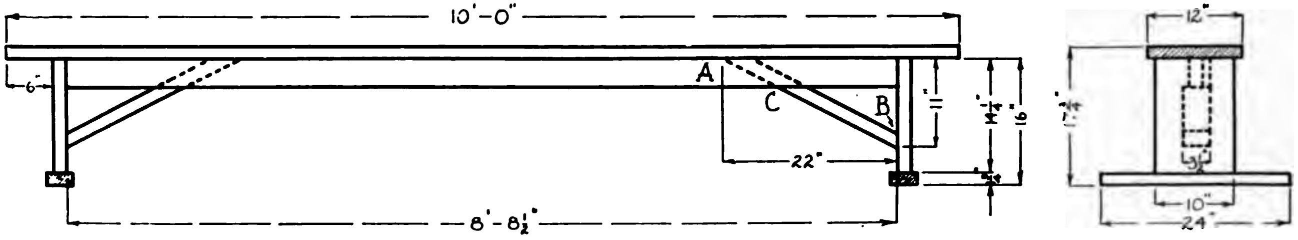
Working Directions. Saw Nos. 1, 2, 3, and 4 to dimensions given in bill of stock. Lay off pieces No. 4 to a 45° angle with the square, then saw. Rip the three 14' pieces of studding into two equal parts, then with the square and pencil lay off and saw the partition pieces marked *C* in the drawing, so that one sawing will make the angles of two ends, thus saving time and material. Lay off and saw the braces marked *D* in the drawing.

Nail together the back part of the frame first, then to this add the front floor pieces. Nail on the two end side braces, the two inner back braces, and last the supports for bicycles.

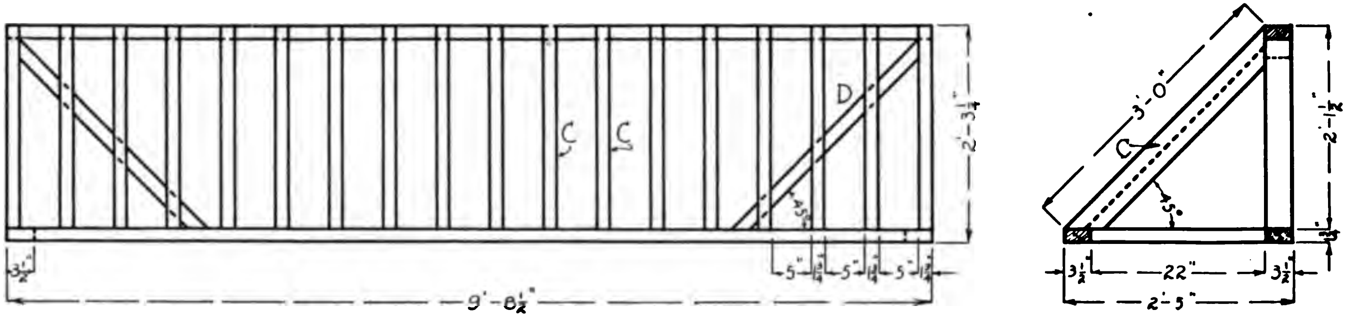
Give two coats of paint, preferably a dust color so that mud and dirt will not show so much.

PLATE

PLAYERS' BENCH



BICYCLE RACK



SPRING JUMPING BOARD.

This is an excellent article for the boys and the girls who like to get together at some home for a wholesome good time. It will do excellent service also on the school grounds or in the city play park. While it is perfectly safe and enjoyable for the toddling baby, it is just as fun-giving for boys and girls who are well grown up.

Material. Elm or some tough springy wood for the top boards.

Two pieces ⅞"x6"x12'.
One piece ⅞"x6"x14'.
One piece 1¾"x3½"x8'.
One piece 6" cedar post 24" long.
Eight bolts with washers ⅜"x5".
Two leather straps 24" long.
Some 8d common nails.

Bill of Stock.

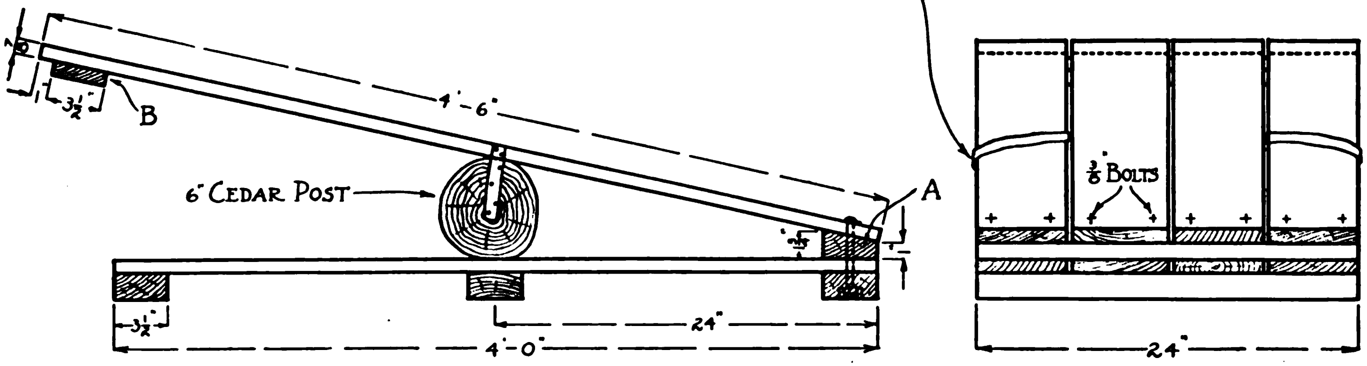
Four pieces ⅞"x5¼"x4'6".
Four pieces ⅞"x5¼"x4'.
Four pieces 1¾"x3½"x24".
One piece ⅞"x3½"x24".
One 6" cedar post 24" long.

Tools. Saws, plane, brace, ⅜" bit, extension bit, gage, and hammer.

Working Directions. Cut all pieces to dimensions given in the bill of stock. Set the gage to 1", and gage along one edge of a piece of studding. Then plane off the wood to the opposite corner as shown at *A* in the drawing. This makes the bevel for the upper boards. Make the lower platform, nailing on the boards securely at all places except at the rear end where bolts are to be used. To hold the rear piece in place put in a nail temporarily. Now make the upper section. Nail the upper end *B* permanently. Put a few nails in the lower end avoiding the places where bolts are to be placed. Place the two parts together and tack a piece of wood on each side at *A* to hold them together until the bolts may be put in. Bore the holes for the bolts. On the under side with an extension bit bore out a large enough hole to admit a wrench to tighten the nut. Bore the hole deep enough so that the nut will be flush with, or below the surface. A chisel or gouge may be used instead of an extension bit. A washer should be placed at both ends of the bolt as a great deal of strain and hard usage will be given the spring board. Fasten the cedar post in place with leather straps, instead of nailing, thus giving it more room for play when the board is in use, and giving more spring to the board.

PLATE

SPRING BOARD



INDOOR PARALLEL BARS.

Every school gymnasium has at least one set of parallel bars, and every school, whether or not it has a gymnasium, can make excellent use of a set of bars. Boys need something to give them interest and exercise on rainy days when it is impossible to be out of doors during intermissions.

While parallel bars are used mostly at school, they are excellent for the boys to use in their homes. These are designed to be used indoors, but they may be set on any smooth level place in the yard. It will be an easy matter to get your boy friends to collect at your home for play if you can make some such apparatus for play as the bars given here.

Material. Yellow pine.
One piece 3½"x3½"x12'.
One piece 3½"x3½"x10'.
Two pieces 1¾"x3½"x8'.
One piece 1¾"x8"x14'.
One piece 1¾"x17"x8'.
Four pieces iron ¼"x1¼"x12".
Some 10d, 12d and 16d common nails.

Bill of Stock. Finished dimensions.
Four pieces 3½"x3½"x4'9".
Two pieces 1¾"x3½"x7'6".
Two pieces 1¾"x8"x4'5".
Four pieces 1¾"x8"x12".
Four pieces 3½"x3½"x7".
One piece 1¾"x17"x7'2".

Tools. Saws, plane, chisel, try-square, framing square, compass, hammer, screwdriver, wood file, draw knife, paper and pencil.

Working Directions. Begin by making the two bars. Sight with the eye along the edge of the piece of studding. Should there be a curve in the studding, place this curve upward.

On a piece of paper 3½"x9" draw the curve that is to shape the end of the bar at *C* in the drawing. Trace this curve on the ends of the two bars. With the draw knife, plane and wood file, work down to a smooth rounded surface.

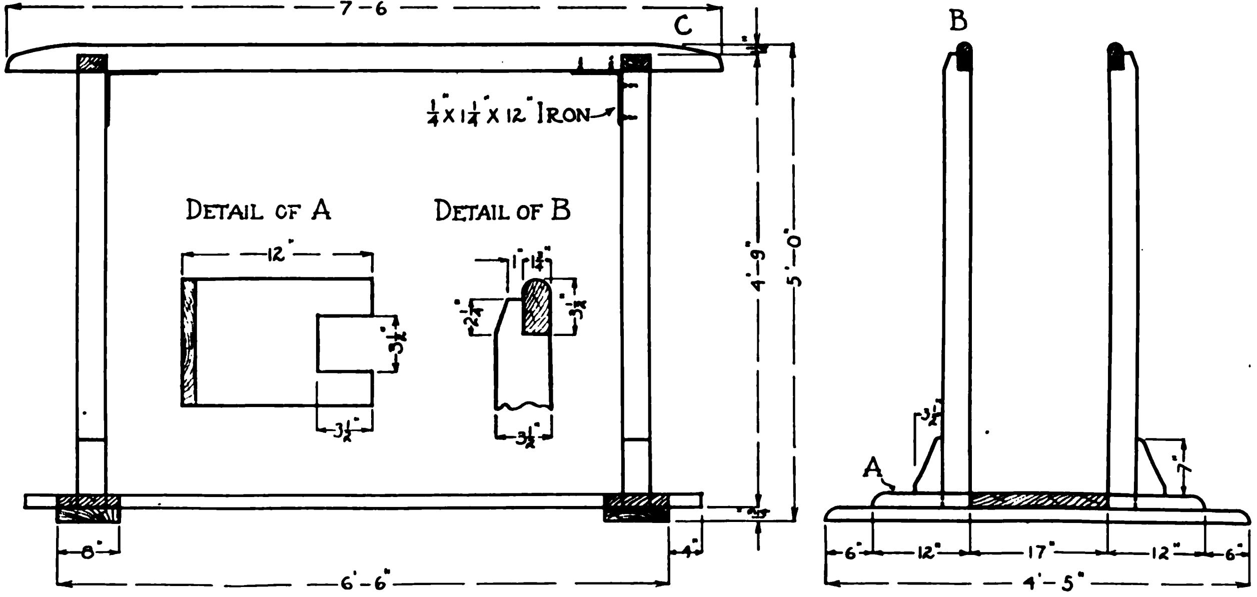
To round off the entire length of the top edge of the bars, set the compass to ⅞" and draw a semicircle on each end. Plane down as in planing a cylinder, first planing the corners, then each succeeding corner until the edge is well rounded. File and sandpaper smooth.

Proceed now with the rest of the frame work. Cut the 3½"x3½" posts to 4'9", being sure that the bottom end is perfectly square. Lay off the upper end as shown in detail *B* so that the two bars have a notch to rest in. To do this, measure down from the end and square across, marking around the entire piece. Set the gage to 1¾" and gage upward from this line on two sides and across the end. This marks the notch which holds the horizontal bar. To mark the chamfer on this same end, measure over 1" from the last gage line and draw a line to the first gage line. Saw out the notch accurately, since the success of the project depends upon the fit of the joints. Saw off the corner to give the chamfer and plane the surface smooth to prevent injury to the hands and wrists.

To make the lower crosspieces, set the compass to 1¾" and make a quarter circle on each edge to use as a guide in rounding off the corners with a plane. Lay off the positions for the posts, and drive several spikes thru the crosspieces into the posts. Detail *A* shows how a notch is cut in the piece of wood so that it fits snugly around the post. In laying out this notch joint, measure your post accurately, since the sizes often vary. Saw and chisel out the opening, slip the piece against the post and nail solid. Be sure the post is exactly perpendicular be-

PL

INDOOR PARALLEL BARS



fore nailing. Fit and nail in the long boards which form the 17″ wide floor. Fit it tight at the posts. Shape the four short braces as shown in the drawing. They are shaped thus so that nails may be easily driven into the posts and lower boards. Now nail on the two parallel bars.

To give added strength, put on the four angle irons at each inner corner, using four large screws in each iron. These irons are not necessary if the bars are to be used by small boys, but if they are made for older boys and men for gymnastic purposes, the irons are needed.

Paint to harmonize with the surroundings.

CHEST WEIGHTS.

The muscles of the chest, back and shoulders, and arms are developed by this set of chest weights, and deep breathing and erect carriage are augmented to a very considerable degree.

By using different weights, it may be adapted to people of different strength, children as young as three years being able to use it as well as grown men and women.

Materials.

Two pieces 1¾"x3½"x8'.
One piece 1¾"x3½"x2'2".
One piece ⅞"x8"x10'.
One piece ⅞"x6"x5'.
Two 4½" handles.
Six 2" screw eyes.
Two pulleys with 2¼" wheel.
Two galvanized awning pulleys with 1¼" wheel.
Sixteen feet of sash cord.
Eight 1¼" screws to fit pulleys.
16d and 8d common nails, also 8d casing nails.
Some fine wire for handles and coarse wire for sandboxes.

Bill of Stock. Finished dimensions.

Four pieces 1¾"x3½"x3'11¼".
One piece 1¾"x3½"x2'2" for top.
One piece ¾"x8"x2'2" for bottom.
Four pieces ⅞"x1"x3'7¾".
Four pieces ¾"x1¾"x3'7¾".
Four pieces ¾"x6"x6" for fronts and backs of sandboxes.
Four pieces ¾"x6"x5¼" for sides, fronts and backs of sandboxes.
Two pieces ¾"x6"x6¾" for bottoms of boxes.
Four pieces ⅝"x⅝"x6¾" for runners on boxes.

Tools. Saws, plane, gage, rule, try-square, brace, small drill to make holes for screws, wire cutters, ⅜″ bit, and hammer.

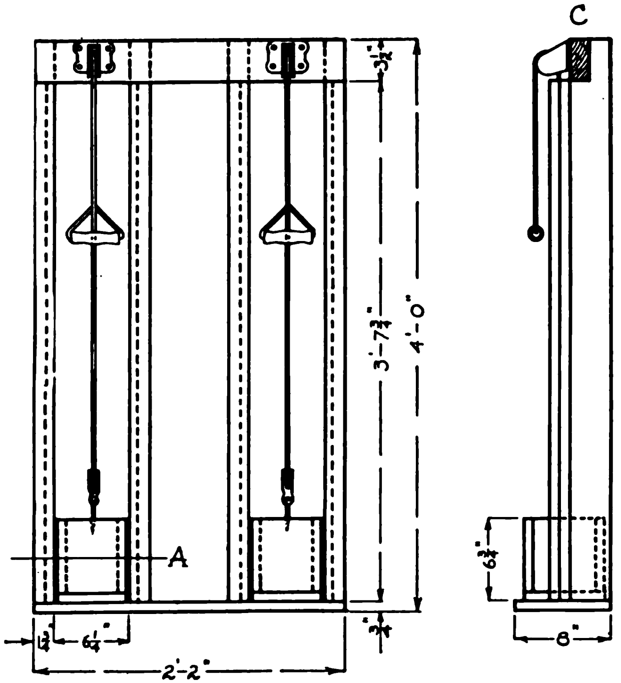
Working Directions. Cut to dimensions all pieces mentioned in the bill of stock. This finishes all pieces except the four uprights. Cut a notch in one end of each to hold the horizontal 2x4 as shown in the drawing as at *C*. Saw this out carefully to make a good joint.

Lay the four pieces of studding on the floor or bench, picking the best and straightest sides for the inside, since these are to form a slide. There is a right and left piece to each slide. Mark these. Then nail on the 1″ pieces as shown at *B* in the detail. When these are in place nail on the 1¾″ pieces. Select the two outside uprights which have been completed and nail on the top crosspiece, then the base. Lay off the space for the two inside uprights. These must be 6¼″ apart when nailed in place. Nail these in at the top, but do not nail them at the bottom until after the weight boxes have been tried out.

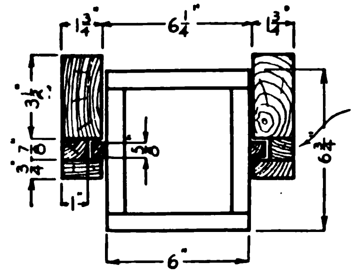
Nail the weight boxes together. These should be well nailed since they must stand considerable weight and bumping. Before nailing the pieces that slide in the groove to the boxes, try them in the groove, sliding them up and down to see that they work freely. Nail these pieces to the boxes. Put the screw eyes into the top of the boxes,

PLATE

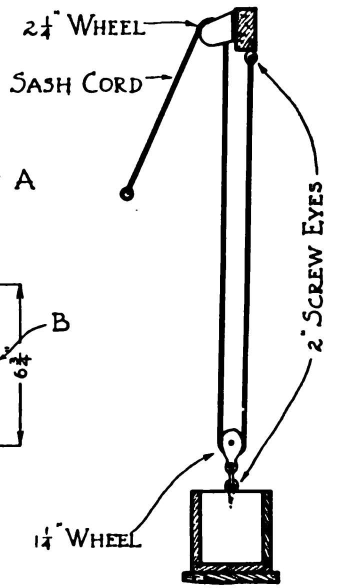
CHEST WEIGHTS



CROSS-SECTION THRU A



DETAIL OF ROPE AND PULLEYS



s. Put the larger pulleys
the center of the space.
e crosspiece put in screw-
lleys.) Tie the sash cord
in position, slip the loose
wer pulley, then upward
box up and down several
well, then nail the two

o shape on the lathe and
thru the center. Slip the
, place the two pieces of
e plenty of room for the
of cord together.
atch the color scheme of
To fasten into position
t the bottom, then either
the wall.

EIGHTS.

le as a companion for the
exercises particularly well
ck, but the muscles of the
l. Too much can not be
with this style of appa-
et little exercise, but also
ar work but need the deep
rcises.

" wheel.

Two screw pulleys with 1½" wheel.
Thirty feet of sash cord.
Some wire and an assortment of nails.

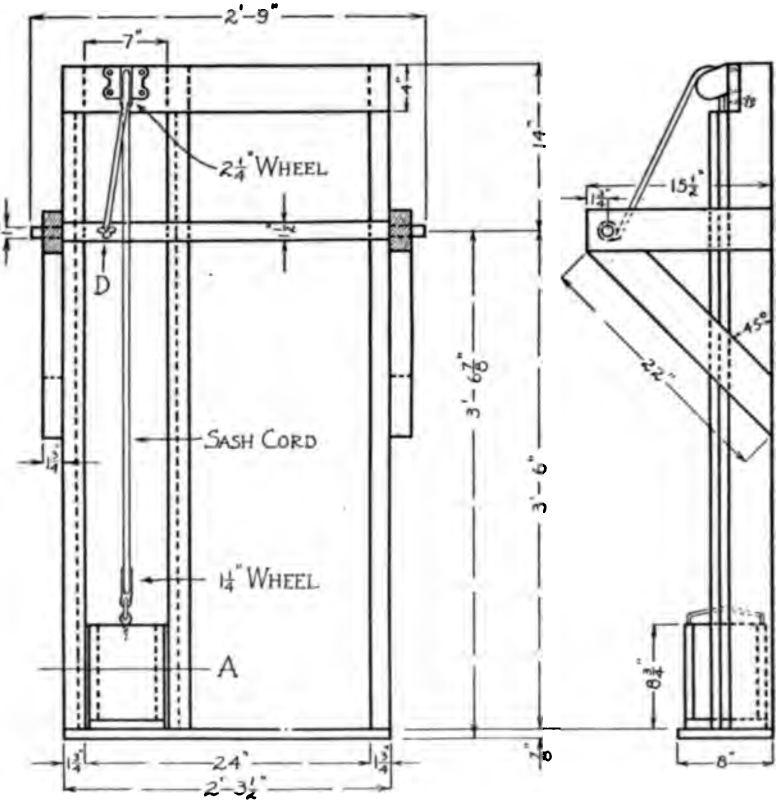
Bill of Stock. Finished dimensions.

(1) Two pieces 1¾"x3½"x7'6" for outside uprights.
(2) Two pieces 1¾"x3½"x4'9½" for inside uprights.
(3) Two pieces 1¾"x1¾"x24" for upper projections.
(4) One piece 1¾"x3½"x2'4" for front crosspiece.
(5) Two pieces 1¾"x3½"x2'9½" for braces.
(6) One piece 1¾"x3½"x2'0½" for middle crosspiece.
(7) One piece ¾"x8"x2'4" for base board.
(8) Two pieces ¾"x1¾"x5' for part of slide.
(9) Two pieces ⅞"x1"x5' for part of slide.
(10) Two pieces ¾"x6"x6¾" for bottoms of sandboxes.
(11) Four pieces ¾"x6"x6" for fronts and backs of sandboxes.
(12) Four pieces ¾"x6"x5¼" for sides of sandboxes.
(13) Four pieces ¾"x¾"x6¾" for runners on boxes.
(14) Two 1"x4" handles.

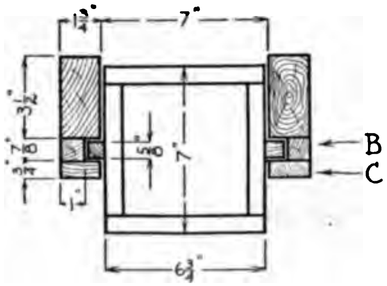
Tools. Saws, planes, gage, try-square, framing square, rule, hammer, brace, ¼" and ½" bits, and 5/32" drill bit.

Working Directions. Measure and saw out the uprights and parts of carrier first, Nos. 1, 2, 8 and 9 in bill of stock. Place the back pieces in position so as not to confuse the right and left sides that will be required in order to make the slide for the sandbox. See the detail marked "cross-section thru *A*." When you are sure of your position nail the ⅞" piece to the back with 1½" finishing nails; then nail the ¾" piece to this. Care must be taken that nothing extends into or obstructs the groove. Saw out the baseboard and middle crosspiece, Nos. 6 and 7 in bill of stock. Nail these and the two outer uprights together. Measure in 6¼" from each outer upright as shown in the detail, and nail in the middle uprights at the top, leaving the base of these two inner pieces free, or for convenience nail them temporarily, enough to hold them in place, since the sandboxes have yet to be made and placed into position.

TWISTING ROD OR GRIP BAR



CROSS-SECTION THRU A



FILL BOX WITH SCRAP IRON, SAND ETC., UNTIL HEAVY ENOUGH

Saw out Nos. 3, 4, and 5 in bill of stock, making No. 5 into braces with the ends mitered to 45°. For convenience nail *C* to *A*, and then *B* to *C* and *A* before nailing *B* to the top of the uprights. Before nailing the braces be sure that each brace is an equal distance from the top.

The boxes should be strongly made. Make the pieces that are to be used for slides and try each one in the place for which it was intended, in order to be sure that it works smoothly. When you are sure these slides are correct, nail them to the boxes. Drill small holes in the middle of the front and back of the boxes and put in the screweyes; then wire on the small pulleys at the bottom, slip the boxes into place and nail the middle uprights into position, first being sure that the box slides smoothly when in the correct position.

Bore ¼" holes for the screw pulleys in the positions shown in the drawing, and screw them into place. Put in the screweyes underneath the middle crosspiece and tie the sash cords to these eyes. Put in the sash cord as shown in the detail of pulleys. All is now completed except the handles. Use two pieces of pine 1" square and 4" long, and if the shop contains a lathe turn out the handles and bore holes large enough to admit the sash cord. If you have no lathe use a plane and a wood file, slip the cord thru the handle and wire the end, leaving plenty of room for the hand.

Paint or stain the apparatus to suit the place where it is to be used. The painting should be done before the pulleys are fastened in position, thus insuring a much neater job of painting.

Nail the apparatus to the wall; if indoors be sure it is where the person using it can get an abundance of fresh air.

TWISTING ROD OR GRIP BAR.

Persistent exercise with the grip bar for a few minutes every day will develop hard arm muscles and an iron grip, both of which are much to be desired by every boy and man and by most girls.

Material. Yellow pine.

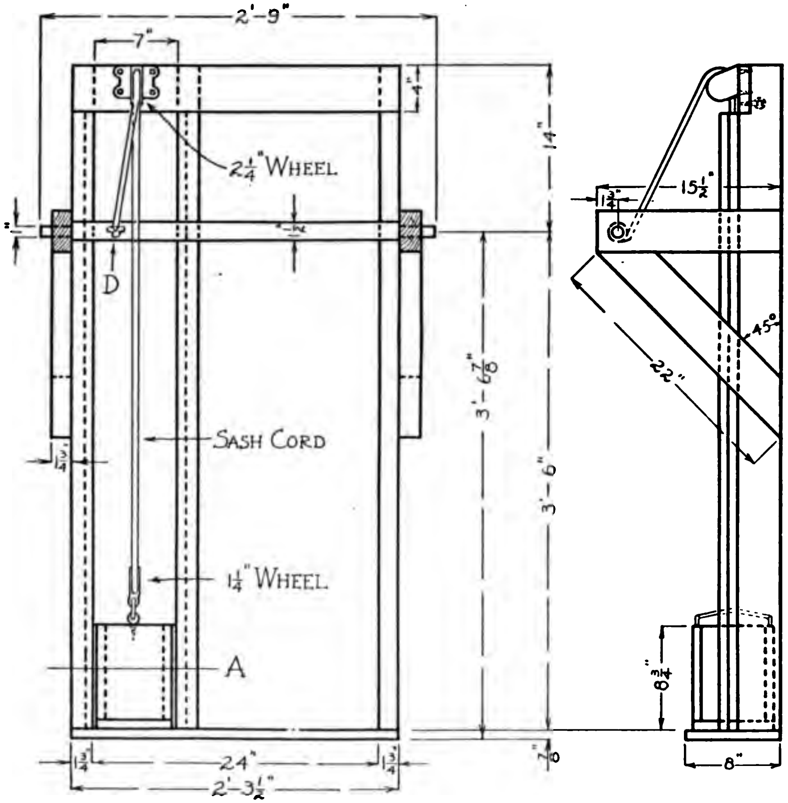
One piece 1¾"x3½"x14'.
One piece 1¾"x3½"x8'.
One piece ⅞"x8"x12'.
One piece 1½"x1½"x2'9".
Eight feet of sash cord.
Three 2" screw eyes.
One galvanized awning pulley with 1¼" wheel.
One pulley (and screws) with 2¼" wheel.
Some wire and an assortment of nails.

Bill of Stock. Finished dimensions.

(1) Three pieces 1¾"x3½"x4'8" for uprights.
(2) Two pieces 1¾"x3½"x22" for braces.
(3) Two pieces 1¾"x3½"x15½" for arms.
(4) One piece ⅞"x8"x2'3½" for base.
(5) One piece ⅞"x4"x2'3½" for upper crosspiece.
(6) Two pieces ¾"x1¾"x4'4" for slide.
(7) Two pieces ⅞"x1"x4'4" for slide.
(8) One piece 1½"x1½"x2'9" for grip bar.
(9) One piece ¾"x6¾"x7" for bottom of box.
(10) Two pieces ¾"x8"x6¾" for front and back of box.
(11) Two pieces ¾"x8"x5½" for sides of box.
(12) One piece ⅝"x⅝"x8¾" for runners on boxes.

Tools. Saws, plane, framing square, try-square, gage, rule, brace, 1" and ⅜" bits, small drill to start holes for screws, and hammer.

Working Directions. Cut all pieces to dimensions mentioned in the bill of stock. Notch out the ends of each upright piece of studding so that the top crosspiece will


2'-9"
7"
4"
14"
2¼" WHEEL
1"
½"
D
3'-6⅞"
3'-6"
SASH CORD
1¾
1¼" WHEEL
A
1¾
24"
1¾
2'-3½"
⅞"
1¾"
15½"
45°
22"
8¾"
8"

fit flush with the studding. To make the slide for the box weight nail 1″ pieces on two of the uprights as shown at *B* in the detail. Nail *C* on over *B*. This makes a groove for the ⅝″ piece nailed to the box to slide in. Lay the two outside uprights down on the floor and nail on the upper and bottom crosspieces. Lay off a distance 7″ from the left upright for the middle upright, and mark. Put one nail in upper crosspiece to hold this third upright in place, but do not nail the bottom.

Plane the 1½″ square piece for the twisting rod to a cylinder. Then measure in 2¾″ from each end and work the ends of twisting rod down to 1″ in diameter. If you have a lathe with a long enough bed, this cylinder can be better and more easily made. Bore a ⅜″ hole thru the center of the large part of cylinder, 3½″ from the end of the large part, as at *D*. The sash cord passes thru this hole. Bore a 1″ hole in the end of each 15½″ arm, the center of the hole being 1¾″ from the end. Nail on the arm at the left, and slide the end of the cylinder thru the hole. Slide the right arm over the other end of the cylinder and nail the arm in place. Nail on the braces. Make the box from pieces mentioned in Nos. 9, 10, and 11 in the bill of stock, the box being 6¾″ long, 7″ wide and 8¾″ deep. Nail it together securely, since heavy material will be used in the box for weights. Put a screweye in both the front and back, also nail on the piece that holds the box in the groove. Wire on the lower pulley.

Put the upper pulley in the middle of space between the two grooves. Also put a screweye in at the back. Tie the sash cord to this screweye, run the rope down thru the lower pulley, up thru the upper pulley and thru the hole in the twisting rod where it should be cut long enough to tie a knot. Run the box up and down a few times to be sure that everything works well. Leave plenty of room for the box to move freely, since the wood will swell or twist in damp weather.

Nail the middle upright permanently. Load the box with lead or sand until the weight is right. Do not get a false idea that you must use a heavy weight to develop the wrist and grip. A moderately heavy weight with oft repeated exercise of the wrist, forearm and finger muscles will develop the muscles much better and much faster.

PUNCHING BAG FRAME.

This punching bag frame is designed to be plain and strong. It is easy of construction, yet care must be used to make it very firm and solid, since the jarring from the punching bag will tend to make it shaky. The frame is nailed against the wall at any height, to suit children or grownups. The attic, back porch or outbuildings afford excellent places for its use at home, while it also fills an important place in the school gymnasium.

Material.

One piece 1¾″x3½″x5′.
One piece ⅞″x4″x12′.
One piece ⅞″x4″x16′ flooring.
One piece ⅞″x4″x10′ flooring.
Some 8d casing and 8d common nails.

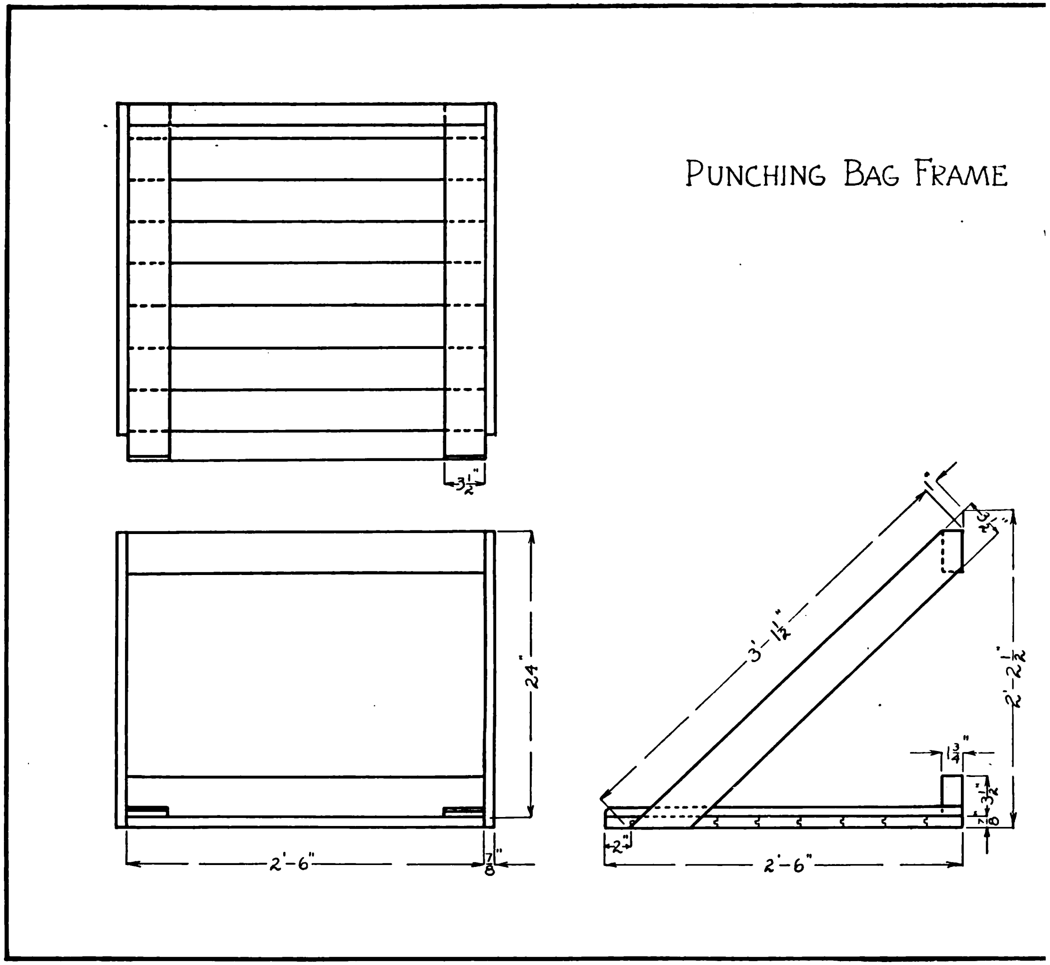
Bill of Stock. Finished dimensions.

Two pieces 1¾″x3½″x2′6″.
Two pieces ⅞″x3½″x2′6″ for supports for flooring.
Two pieces ⅞″x3½″x3′1½″ for side braces.
Ten pieces of 4″ flooring 2′6″ long.

Tools. Saws, plane, rule, pencil, try-square, gage, draw-knife, framing square, and hammer.

Working Directions. Make the suspended ceiling of the frame first. Saw from the 4″ boards, two pieces 2′6″ long, planing the edges if necessary. Plane a ¼″ chamfer on one end of each length, as shown at *B*. With the draw-knife and plane take off the groove on one piece of flooring. Measure carefully and put a nail in each end to

PUNCHING BAG FRAME



hold the board in place. Tack on a piece at the other end to keep the two crosspieces an equal distance apart. Test with the framing square before nailing permanently. Nail on all the pieces in the same manner as you would flooring. If you have plenty of material it is better to have the ends stick over the edges a short distance and saw them off later.

Fit on one of the pieces of studding as shown at *A* in the isometric sketch. To fit this studding, cut notches ⅞" deep and 3½" long on each end as shown in the sketch. Nail the piece of studding in place. To get the lower angle on the brace, take 15" on one arm of the square and 13¼" on the other arm. Reverse this for the angle at the other end. Nail the braces to the floor of the frame, then nail the upper studding in place. Saw off the upper protruding corner.

A swivel to which the punching bag is attached may be bought from any concern that handles sporting goods, and should cost from 35 to 50 cents.

This whole structure should be solidly constructed, since it will have considerable shake while in use. The frame should be painted or stained to match the woodwork where it is hung.

LADDER FOR GYMNASIUM.

The suspended ladder is one of the pieces of apparatus for every indoor gymnasium. Walking on this ladder gives a kind of exercise that cannot be gotten in any other way. There are numerous pieces of apparatus for exercising the arms, legs, etc., but few give attention to the stretching out of the bones and cushions of the back. Hanging and walking with the hands on this ladder tends to straighten out the body, loosening up the vertebra, stretching the muscles of the shoulders and loosening the joints generally. It encourages deep breathing and straightens curved spines. The author has found that to get the best exercise from the ladder one should catch hold of the ladder, and as much as possible relax the muscles of the back and lower part of the body, then walk or swing from one round to another. This relieves that settling down or general tiredness of the body that results from continued standing, sitting or stooping. Many other feats that give good exercise may be performed on the ladder.

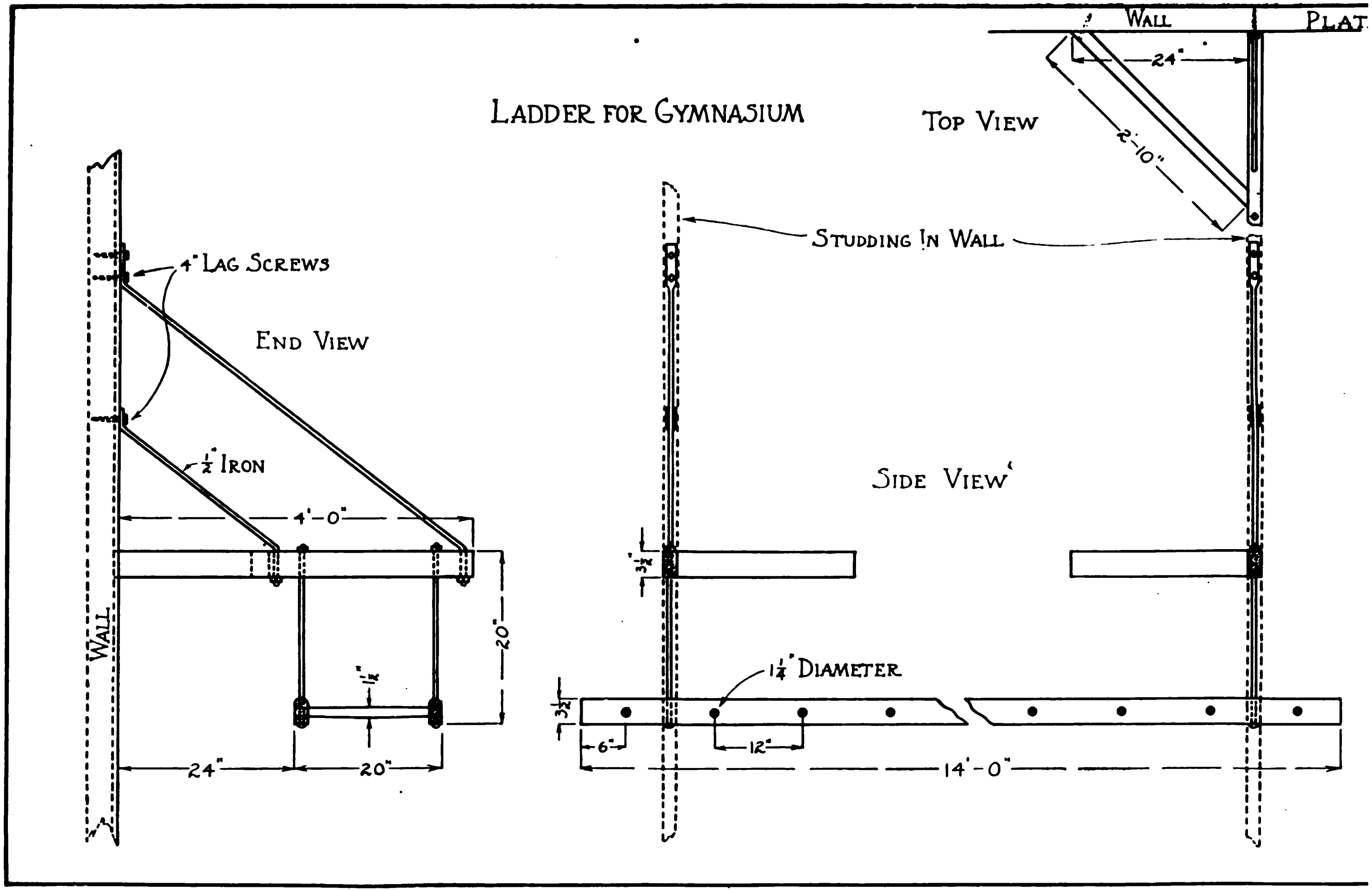
Material. Finished dimensions.
Two pieces 1¾"x3½"x14' for ladder.
Two pieces 1¾"x3½"x4'.
Two pieces 1¾"x3½"x2'10" for braces.
Fourteen pieces 1½"x1½"x22" for rounds.
Two pieces ½"x6' Round Norway iron.
Two pieces ½"x3' Round Norway iron.
Four bolts ½"x24".
Six lag screws ⅜"x4".
Some 16d nails and long brads.

Tools. Lathe and tools, forge and forge tools, saw, framing square, brace, ½", 1", and 5/16" bits, compass and hammer.

Working Directions. On the lathe turn out the fourteen rounds for the ladder. These are to be 20" long, the pieces being 22" long leaves 1" at each end for the centers on the lathes. Make the pieces 1½" in diameter at the middle and 1" at the ends. Hickory, pecan or ash make very good rounds since they are tough and will not break easily.

On the two 14' lengths, beginning 6" from one end, lay off fourteen marks 12" apart, the entire length of the piece. Bore a 1" hole at each point. Set the compass at ⅞" and draw a semicircle at each end of the 14' studding. Plane the entire length of the piece until it conforms to the semicircle at the end, and sandpaper smooth. This rounds the top surface. Fit the rounds into place and put a long brad

LADDER FOR GYMNASIUM



thru each end of a round from the under side. Be sure that the brad is not too long.

This ladder has been designed to hang from a side wall, and the iron and other materials are figured with this purpose in mind. If the ceiling is low the ladder may be hung from the ceiling. The conditions will alter the manner in which the ladder will be suspended. Using the design in the drawing, two ½" holes should be bored thru the ladder 12" from each end for the suspension bolts.

In the forge shop bend, thread, and flatten the pieces of iron to conform to the measurements shown in the drawing. The long 6′ pieces should be bent 4½" from the end and flattened, and ⅜" holes bored with a post drill for the lag screws. The lower end should be threaded down 1½". The shorter braces have the same 4½" bend at one end but a shorter flattened piece at the other end since only one lag screw is to be used. Measure in on the 4′ pieces of studding 1½" from the end, 3½" further, then 20" and 3½". Bore ½" holes at these points for the braces and bolts. Miter the two 2′10" braces at each end at an angle of 45°.

Measure off on the wall two points 12′ apart and toe-nail to the wall the 4′ pieces of studding. Nail on the braces. Put the iron braces in place, and mark the places for the lag screws. Bore a $\frac{5}{16}$" hole for each lag and put in the screws. Put on a washer and nut at the lower end, and turn until the brace is at right angles with the wall. The ladder should now be put in place.

DUMB-BELLS AND INDIAN CLUBS.

These articles have an important place in gymnasium work, but more especially are they of value to those who must take their morning and evening exercise at home in the bedroom. The ornamentation of these articles has been left to the pupil, the author intending to suggest the problems, and to give good proportions and the material required.

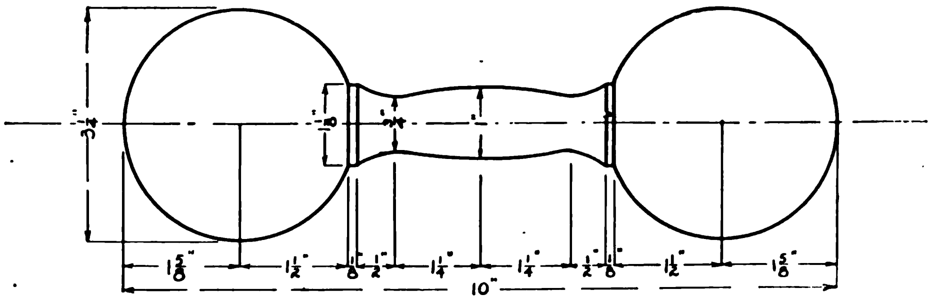
Material. Hard maple will prove the most satisfactory for both of these problems, altho any hard wood that does not split easily may be used. A combination of maple and walnut makes a very pleasing Indian club. In making combinations, always use an odd number of strips, as three, five and seven. Two kinds of wood, dark and light, are usually more attractive, altho three kinds may be used with good effect. Ordinary 4x4's will make the dumb-bells and 3x3's the clubs.

Working Directions. This problem cannot be used unless you have a lathe and lathe tools. The usual processes used with the lathe must be gone thru in making both these problems. For each problem allow about 2" more stock than the drawing calls for, to allow for centering and cutting off. If a combination of woods is used very accurate centering will be necessary so that the different colored woods on each side will be well balanced. In turning out these problems follow the usual rules in turning, first turning a cylinder, then marking and blocking out, finishing carefully, sandpapering, staining or shellacing in the lathe, and finally cutting it off.

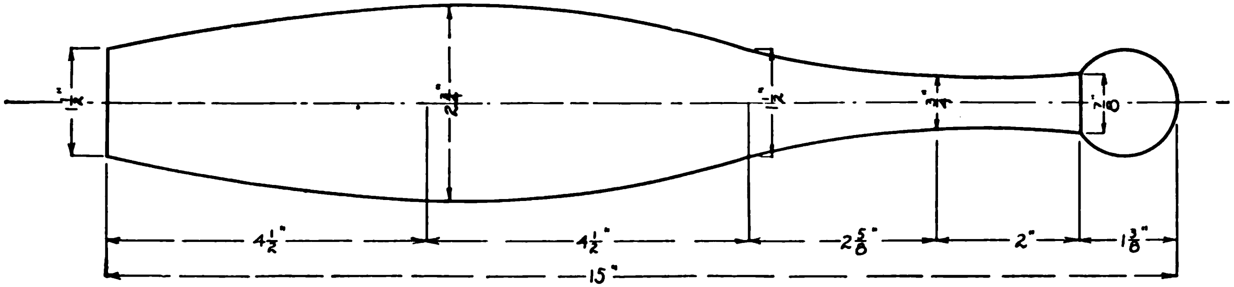
It may be hard to get two pieces exactly alike. If you have several to make it is well to make a templet out of cardboard to use in getting each exactly to dimensions.

PLAT

DUMB-BELL



INDIAN CLUB



LOCKERS FOR SCHOOL OR CLUB GYMNASIUM.

Every school gymnasium has ample use for a good set of lockers where clothing and uniforms may be kept. Lockers are expensive, hence many schools do without them. The design given here is simple and easily constructed. It may be made by the class as a whole, making an excellent group problem, if the teacher so wishes. There are two rows of lockers, one row above and one below the middle crosswise partition. The lockers are smaller than the ones given on another plate, and they are more suitable for smaller articles of clothing, such as tennis shoes, racket and balls, running clothes, etc. The wire on the doors affords the needed ventilation for the clothing.

Material.

Five pieces 1¾"x3½"x12'.
Four pieces 1¾"x3½"x8'.
Eight pieces ⅞"x12"x12'.
Six pieces ⅞"x12"x16'.
Twenty-nine pieces ⅞"x4"x12' ceiling.
Fifteen feet molding.
Twenty pieces ⅜" galvanized wire mesh 9"x3'4½".
Twenty pairs 2" butt hinges with screws.
Twenty locks, or hasps and padlocks.
Five dozen coat hooks.
An assortment of nails and brads. Glue.

Bill of Stock. Finished dimensions.

For Frame.

(1) Four pieces 1¾"x3½"x11'10" for platform and cap.
(2) Two pieces 1¾"x3½"x8½" for platform.
(3) Two pieces 1¾"x3½"x5" for platform.
(4) Four pieces 1¾"x3½"x7'5½" for end uprights.
(5) Two pieces ⅞"x12"x11'10" for floor and top.
(6) Nine pieces ⅞"x12"x7'7¼" for upright partitions.
(7) Eight pieces ⅞"x12"x13⅛" for crosswise partitions.
(8) Two pieces ⅞"x12"x14 9/16" for crosswise partitions.
(9) Two pieces ⅞"x12⅞"x8'1⅛" for ends.
(10) Twenty-nine pieces ¾"x4"x11'11" ceiling for back.
(11) Twenty pieces ⅞"x1⅛"x20" for *A*.
(12) One piece ⅞"x4⅛"x11'11¾" for lower casing.
(13) One piece ⅞"x3"x11'11¾" for upper casing.
(14) One piece ⅞"x2"x11'6" for middle casing.
(15) Two pieces ⅞"x2⅞"x7'6" for end casing.

For Doors.

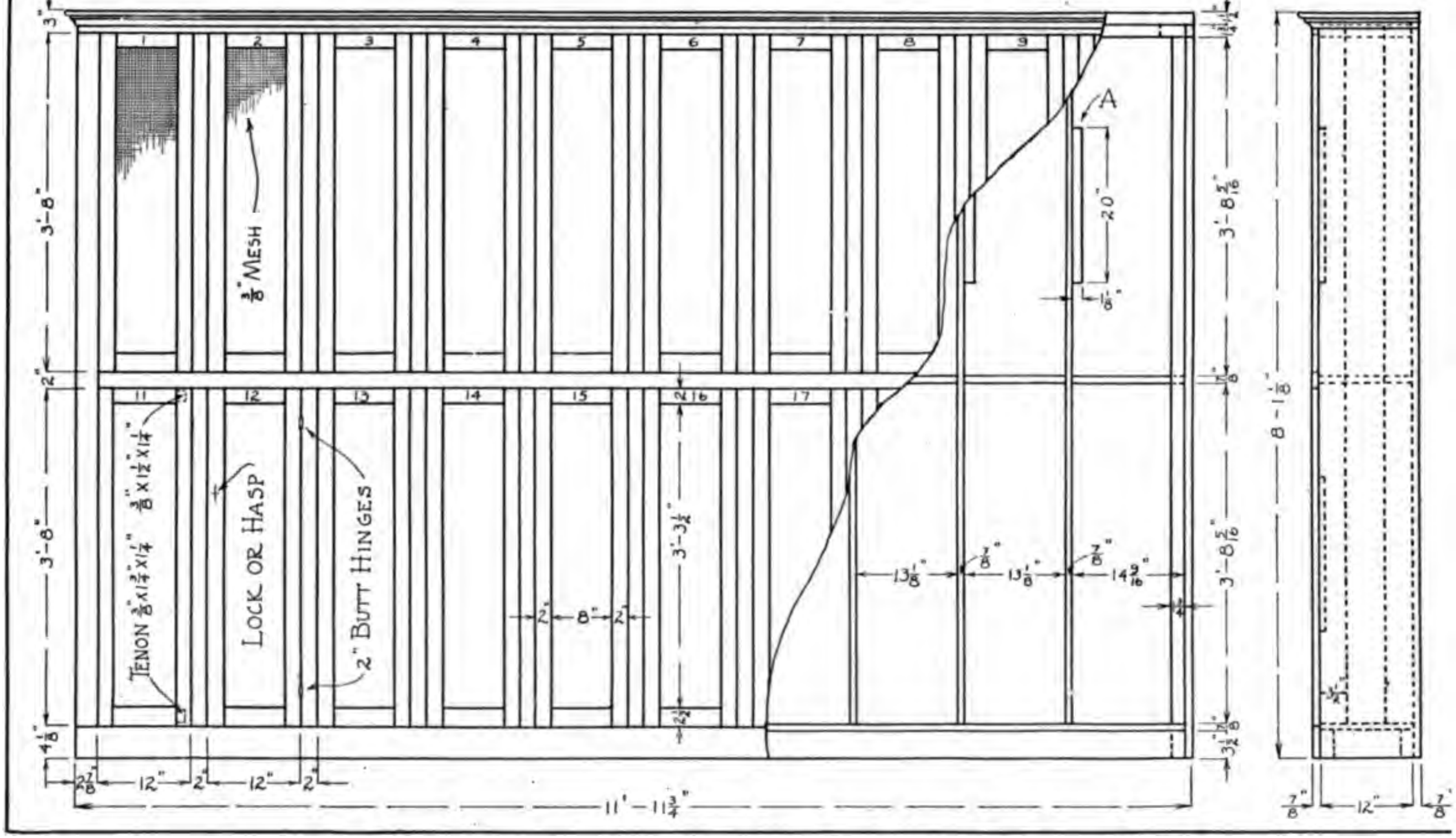
(17) Forty pieces ⅞"x2"x3'8".
(18) Twenty pieces ⅞"x2"x10½".
(19) Twenty pieces ⅞"x2½"x10½".

Tools. Saws, planes, framing square, try-square, gage, brace, ⅜" bit, chisels, clamps, hammer, nailset, laying out tools, screwdriver and plow.

Working Directions. Do not cut all pieces to dimensions given in the bill of stock before beginning to assemble. This is not good policy in a piece of work as large as this. The door pieces may all be gotten out at one time.

Make the lower platform first. Cut the long pieces of studding to length, also all pieces included in Nos. 1 to 4 in bill of stock. Nail the lower frame together, also the frame at the top of the cabinet. Nail on the board which forms the floor. Toenail on the upright corner pieces (No. 4) and nail the upper frame made from studding to the ends of these four posts. On top of this nail on the top board, this being the same size as the board forming the floor. The whole frame should be lying on the floor during these processes. Now put in the upright partitions. These must first be notched out at each top corner to allow them to fit up against the top board. Saw the cross partitions and nail them in. Now nail on the end boards. These boards should either be made of 14" material or 12" stuff with a ⅞" strip nailed or glued on. The inside is plowed out about half the thickness of the board to allow the ceiling to fit flush with the back. Put on the ceiling

LOCKERS FOR A SCHOOL OR CLUB GYMNASIUM



at the back while the cabinet is yet lying on the floor. Now elevate the cabinet. It could be elevated during the entire process but it makes harder work.

Rip out the casings, making them a little long. The lower and upper casings are put on first, then the ends and lastly the middle casing. In measuring the casings take actual measurements, that is, put the casing in position and measure directly on the piece of wood.

Cut the molding, mitering the corners carefully. Nail on the long piece first, then miter the corner, fit and nail into position before sawing off the ends.

All of the material for the doors should be gotten out at one time to save time in laying off and working. Instead of cutting the stiles to 3'8" add 2" to each piece making them 3'10". Begin to mark off mortises 1" from the end. This will allow for bad corners and inaccuracy in planing at the end. Make the mortises and tenons to dimensions given in the drawing. Do not plane the stiles of the doors to exactly 2" wide, but leave the side opposite the joint edge rough. Those may be planed down when fitting the doors into position. The same method should be used with the rails. Put on the wire before fitting the doors into position. Put the hinges and locks on last. Nail or screw on small strips as at *A* to act as bump boards for the doors.

A careful study of the drawing is necessary before beginning a project as large as this.

Stain, paint or varnish to suit the woodwork in the room where the cabinet is to be placed.

LOCKERS FOR CLUB OR TEAM ROOM.

The lockers designed here are particularly for the larger articles of clothing such as football and baseball suits. The problem is an excellent one for a group of boys, and it is not difficult.

Material.

One piece 1¾"x3½"x14'.
One piece 1¾"x3½"x12'.
Ten pieces ⅞"x12"x12'.
Three pieces ⅞"x10"x12'.
Twenty-six pieces ¾"x4"x12' ceiling.
Ten pieces ⅜" galvanized wire mesh 8½"x5'3".
Ten pairs 2½" butt hinges with screws.
Ten combination locks, or ordinary locks and keys, or hasp and padlock, at the discretion of the person in charge.
Fourteen feet of molding.
Three dozen coat hooks.
An assortment of nails and double-pointed tacks.
Glue.

Bill of Stock. Finished dimensions.

For the Frame.

(1) Two pieces 1¾"x3½"x11'8¼" for platform.
(2) Two pieces 1¾"x3½"x8½" for platform.
(3) Two pieces ⅞"x12"x11'8¼" for floor and top.
(4) Two pieces ⅞"x12⅞"x6'5⅝" for sides.
(5) Nine pieces ⅞"x12"x5'9½" for partitions.
(6) Twenty-six pieces ¾"x4"x11'9¼" ceiling for back.

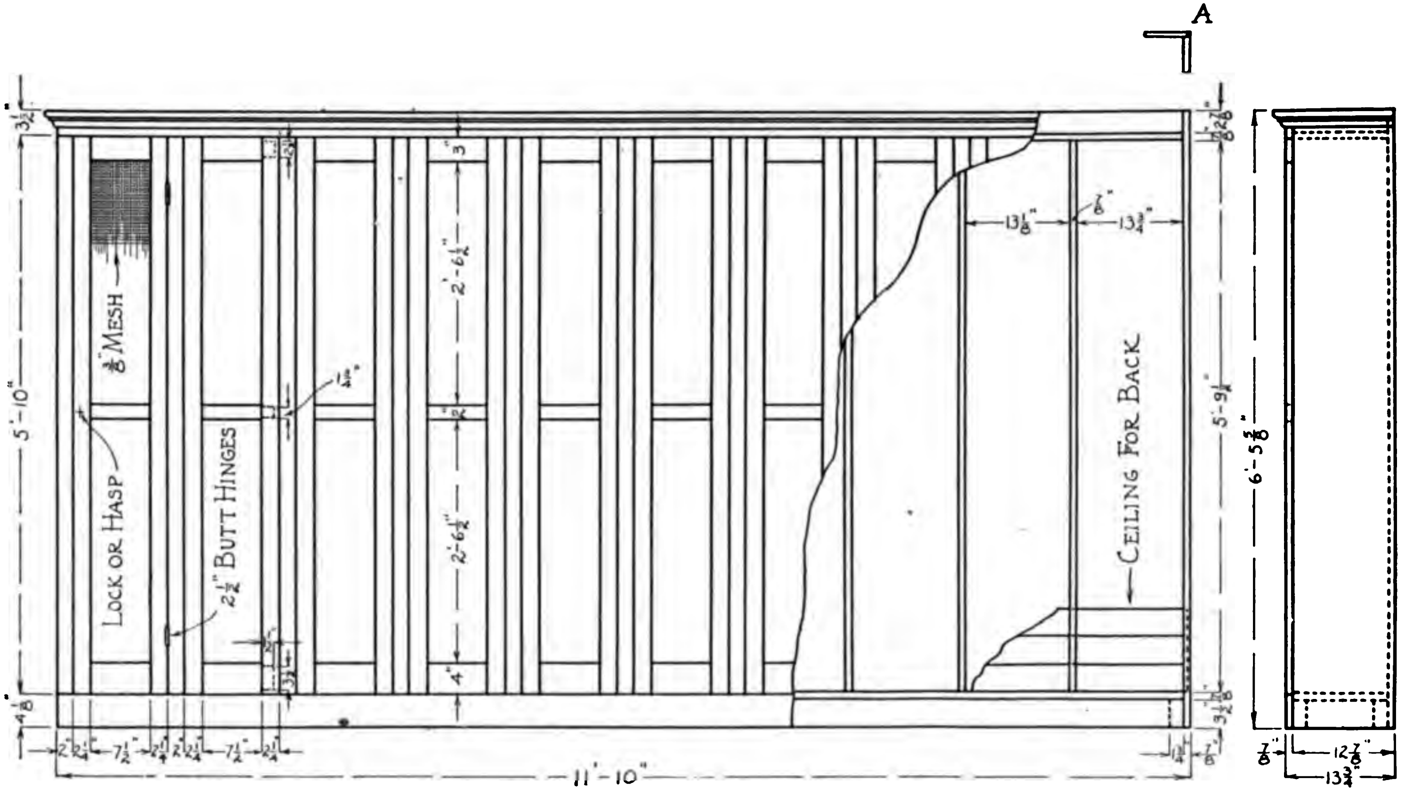
Doors and Casings.

(7) One piece ⅞"x4⅛"x11'10" for lower casing.
(8) One piece ⅞"x3½"x11'10" for upper casing.
(9) Eleven pieces ⅞"x2"x5'10" for vertical casings.
(10) Twenty pieces ⅞"x2¼"x5'10" for stiles on doors.
(11) Ten pieces ⅞"x4"x10½" for lower rails on doors.
(12) Ten pieces ⅞"x3"x10½" for upper rails on doors.
(13) Ten pieces ⅞"x2"x10½" for middle rails on doors.

Tools. Saws, planes, gage, framing square, try-square, rule, brace, ⅜" bit, automatic drill for setting hinges and locks, screwdriver, ¼" and 1" chisels, plow, and hammer.

PLATE

LOCKERS FOR CLUB OR TEAM ROOM



Working Directions. The two side pieces, No. 4 in bill of stock, should be made first so as to allow the glue to set. Either a 14" board must be used or a small strip must be added to a 12" board to make 12⅞". When the glue is set plow out a space deep enough to allow the ceiling to fit flush with the back as shown at *A* in the drawing.

Make the bottom frame from the 2x4's and nail onto this a 12" board for the floor. Now nail on the two side boards. Measure down from the top 3¾" on each end and nail in the top board. Saw, and nail in the partitions. Saw, and nail on the ceiling at the back. This completes the frame.

The next step in the construction is to put on the casings. The bottom, 4⅛" casing, should go on first. All nails for this work should be casing nails, and they should be set. Take care that no hammer marks show. This 4⅛" casing reaches to within ¼" of the top of the lower floor. Put on the upper casing. This also allows ¼" lap for the door. Next put in the vertical casings. Exact measurements as to length should be taken. It is usually customary in this kind of work to allow a little extra length when you saw; then cut on a slant. This tends to wedge and make a good joint, but it must not be so long as to move the lower or upper casings. The molding should go on last. Cut the long piece, first making one miter joint, taking the exact measurement on the inside and then adding the 45° for the joint. Nail this piece on, then cut the miter before sawing to correct length.

The doors should all be laid out at the same time so they will be uniform. All pieces should be cut out first. Instead of sawing the stiles 5'10", add 2" making them exactly 6'. This gives 1" on each end for protection while working. The rails should be cut to exact lengths. Lay out the mortises and tenons to the dimensions given in the drawing. Much time will be gained by doing all the laying out first, then making all the mortises or tenons as the case may be. Fit all the doors together, so as to be sure that they are right, before gluing. When the glue has set, tack the screen on at the back, then fit the doors to the openings. Hang all the doors and put on the locks. Put in the coat hooks.

Paint, stain or varnish the cabinet as desired.

BICYCLE RACK.

This rack is designed to economize space. The front wheel is elevated up over the trough, the hind wheel rests against the lower studding. The wheels are to be put in alternately, one from each side.

The rack may be put in the hallway or basement, or in any out-of-the-way place.

It is made so that it may be added to, a 4x4 being erected every 7'. Any size rack may be made by adding extra lengths of lumber.

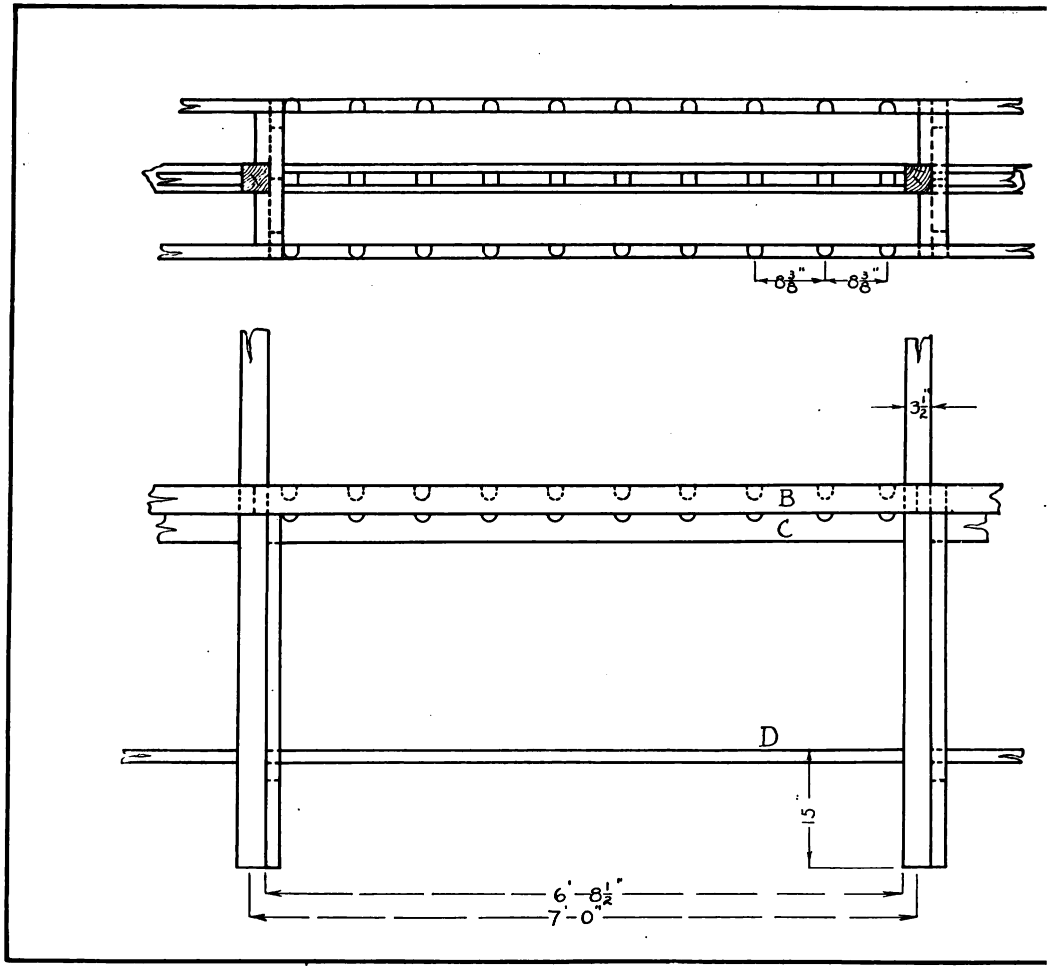
Material.

Two pieces 3½"x3½" x distance from floor to ceiling.
One piece 3½"x3½"x3'.
Two pieces 1¾"x3½"x14'.
One piece 1¾"x3½"x16'.
Some 10d and 16d common nails.

Bill of Stock. For one section.

(1) Two pieces 3½"x3½" x distance from floor to ceiling
(2) Two pieces 3½"x3½"x16½" for cross braces at *A*.
(3) Two pieces 1¾"x3½"x7' for *B*.
(4) Two pieces 1¾"x3½"x6'8½" for *C* and *D*.
(5) Four pieces 1¾"x3½"x3'9½" for braces at *E*.

For each addition add;
One post.
One piece 3½"x3½"x16½".


8 3/8"
8 3/8"
3 1/2"
B
C
D
15"
6'-8 1/2"
7'-0"

Two pieces 1¾"x3½"x7'.
Two pieces 1¾"x3½"x6'8½".
Two pieces 1¾"x3½"x3'9½".

Tools. Saws, plane, gage, square, try-square, gouge, rule, chisel, and hammer.

Working Directions. Cut the posts long enough to be nailed to the floor and to the ceiling. Nail them so that they measure 7' apart from center to center. Nail these in solid. Cut two pieces, No. 2 in bill of stock, and notch out a joint 1¾"x3½" to fit around the posts. This should be measured from the post itself so that it will exactly fit. Slide these pieces into place and nail them to the posts. The three pieces *B* and *C* have small notches, or places gouged out, so that they will hold a bicycle tire. Lay the three pieces together, and with the square and pencil measure and lay out the places for these notches. The depth of each notch may be seen in the dotted lines in the end view of the drawing. When pieces *B* are finished nail them on, being sure that the notches are directly opposite each other. Saw one end of piece *C* so that the notch will be directly in line with the notches in the other two pieces, then actually measure the length and saw. This piece is toenailed to the posts.

Several methods may be used in marking out the braces, *E* in the drawing, and all are practical. An actual full-sized drawing may be made on the floor, showing the end view, and T-bevels may be set to the necessary angles. The different angles may also be gotten from the large square. Nail these braces in place. Piece *D* is the last one to be nailed. This may be toenailed to the posts at one end and to the braces at the other end, or, the brace end may be notched out to fit up to the post.

The builder will have to use his own judgment to a great extent as to the length of the spans between posts, the number of sections, the length of space between notches for wheels, etc.

PLAY.

These problems relate almost entirely to the open-air play of the younger children, altho the toboggan, skee sled, bob sled, and skees, and perhaps some others, will appeal to the older boys. The giant slide, teeter board and horse, the frame for the swing and the jumping board should be found in every school yard or on every campus where grade children play. These afford excellent group problems in carpentry, and school officials will be glad to furnish the lumber when it can be used to such good advantage in the manual training classes.

Some of the articles will be made for the use of the boy himself, in his play away from school and in vacations.

The child's playhouse will afford very excellent study in real house building, and it is of unquestionable value both as an individual problem and as a class problem.

GIANT SLIDE.

Every one who has seen a group of children playing on a slide will know what good uses it will serve. The author has watched the children from two years of age up to fourteen and sixteen, in a continuous merry-go-round of play, which lasted as long as there was light enough to play. By all means make one for your school grounds, and if there are children in the home, make one for them. It will prove a never-ending delight.

Material.

One piece 1¾"x3½"x14'.
One piece ½"x16"x14', or two pieces ½"x8"x14' will do.
Two pieces ⅞"x12"x12".
One piece ⅞"x10"x14'.
One piece ⅞"x10"x10'.
One piece ⅞"x6"x12'.
One ¾"x2'3" round iron rod.
Two dozen ¼"x2" stove bolts.
Eight dozen 1¼" No. 9 flat-head screws.
An assortment of nails.

Bill of Sto

One p
Two p
Two p
Ten pi
One p
Two p
Two p
Seven
One p
Two p
Four
Two p
Two p

Tools. Sa
draw knife,
T-bevel, spok

Working I
ferent sectio
horse at the
together with
apart and ea

The Slide.
the main par
curving out t
on each boar
piece that is
With the pla
upper edge c
round smoot
out two piec
These suppo

Lay these
lay off place
You will not

one being placed flat and the other placed edgewise. Saw and chisel the notches in *B* for the flat pieces so that they will be flush with the upper edge of *B*. To set in the edgewise crosspieces, make notches in *B* to about half the width; and also in the edgewise crosspieces about half their width. These two notches will fit into each other to make a joint. When the notches have all been cut, put pieces *B* onto the sides of the slide with screws. Put in the crosspieces *C*, with screws and nails, so that they will be very solid.

The ½″ piece, or pieces, for the slide must be fitted between the sides. Plan to make the grain of these boards run downward, so that stray splinters will not catch in the clothing. You will not be able to bend this piece to conform to the curve at the bottom without first sawing across the grain at several regular intervals as shown in detail *Z*. This end should also be soaked in water for several hours to make it pliable, before trying to put it in position. If it shows any tendency to break in any particular spot put an extra piece, *C*, in just beneath the place that is weak. Put the slide on with screws. The holes for the screws are drilled, then well countersunk so that the heads will be entirely underneath the surface. An extra brace, *D*, is put on the end to help hold the curved part of the slide in position.

The ladder is made separate from the slide. Set the T-bevel at an angle 3¼″ to 6″ or if you use the large square use 13″ to 24″. See illustration Plate 2. This will give the angle to use in laying out the joints for the steps. Lay off the joints so that there will be a rise of 11″ to each of the seven steps, measuring in each case to the top edge of the step. The lower end of the ladder has a 7′ piece of studding nailed to it to furnish a wide base. This makes it necessary to saw 1¾″ off of the lower end of the ladder carriage in order to make the first step just 11″ high. Cut off the part that projects over the piece of studding as at *Y*. Saw and chisel out the joints for the steps, nail in the steps, then nail on the base. Lay out and saw the braces, *G*, and nail them on.

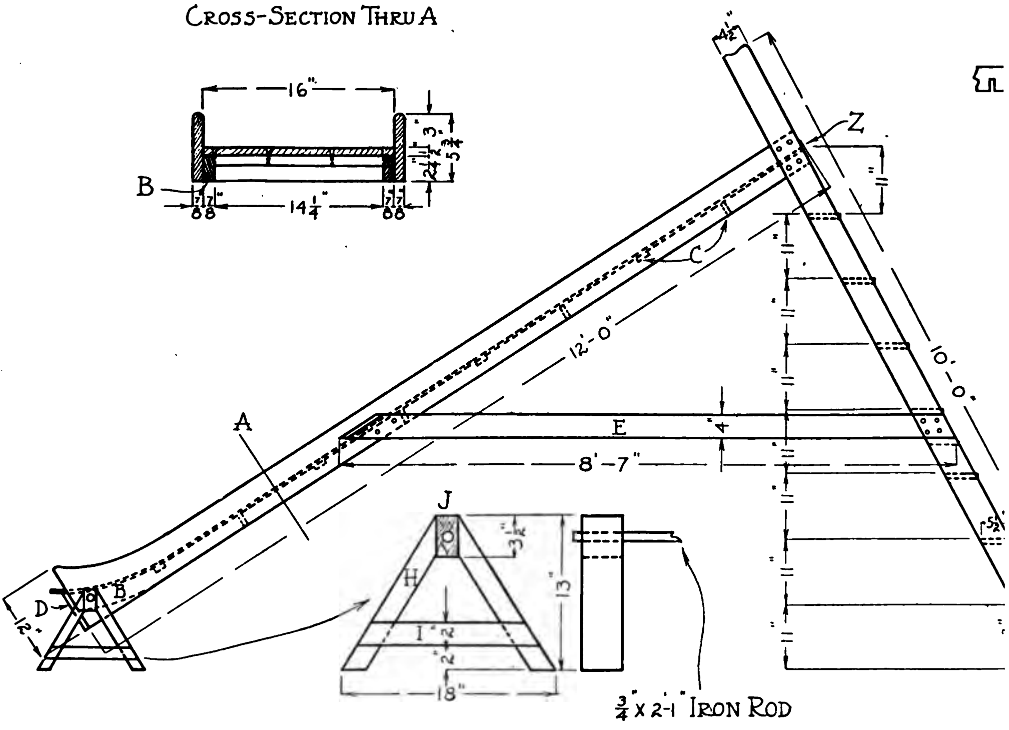
The horses may be easily made by referring to the detail of the drawing. The ¾″ iron rod is put thru the center of the block at *J*, and should be placed just below one of the pieces *C*, so that the main part of the slide will rest on the rod. Just outside the horses drill a small hole through the rod so that a key or pin may be inserted to hold the slide firm.

Make the braces marked *E* in the drawing.

In assembling it is better to first bolt the slide onto the horses, then elevate the slide and prop it up or nail on some temporary braces. The top of the slide *Z* should be 7′4″ from the ground. Place the ladder in position and mark the places for the upper stove bolts. Bore these holes, place the ladder in position again and then mark through these holes to get the points for the holes on the slide. Bore these holes and put in the stove bolts. In like manner put on the braces *E* with stove bolts. This makes it possible to take the slide apart easily, and transport it from one place to another if desired.

This slide should have two or three good coats of paint on all parts except the sliding board. New paint makes sliding difficult, and it soon wears off.

GIANT SLIDE


CROSS-SECTION THRU A
16"
B
7/8 7/8"
14¼"
7/8 7/8
3"
1½"
5¾"
2¼"
A
12'-0"
C
Z
4½"
10'-0"
11"
E
4"
8'-7"
D
B
12"
J
3½"
H
13"
I
2"
2"
18"
¾" x 2'-1" IRON ROD

TEETER BOARD AND HORSE.

The teeter board has a place in the play of every school child, and of the children in the home. It promotes social play among the children, since its use calls for at least two children playing together. Several teeter boards can be accommodated on the horse given here.

Material.

One 14' telephone pole about 10" in diameter at the small end.
One piece 3½"x3½"x12'.
One piece 1¾"x3½"x6'.
One piece ⅞"x8"x8'.
Eight lag screws ⅜"x4".
Some 16d and 10d common nails.

Bill of Stock. Finished dimensions.

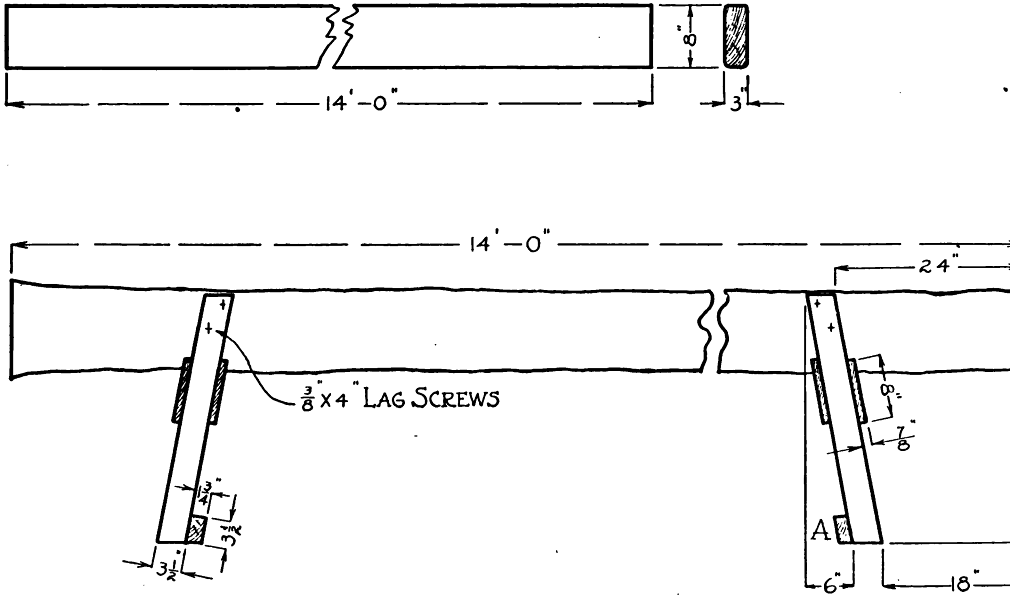
Four pieces 3½"x3½"x2'11" for legs.
Two pieces 1¾"x3½"x3' for braces.
Four pieces ⅞"x8"x24" for braces.
One piece 3"x8"x14' for teeter board.

Tools. Saw, plane, chisel, draw knife, T-bevel, brace, 5/16" bit, mallet, and hammer.

Working Directions. The teeter board requires but little work since only the corners are to be rounded off with the plane and then sandpapered.

The making of the horse will in a measure test the eye and the ingenuity of the one making the project, since the pole will not be exactly round, and it may be somewhat uneven. Notice from the drawing that the 4x4 legs are 4" apart at the top, and 2'5" apart at the bottom. This will necessitate chiseling away some of the pole. The legs also slant outward, the slant being 6" in 32". Set the T-bevel to this angle. This angle may also be taken from the square, using 1½" on one arm and 8" on the other as shown in the illustration on Plate 2. Cut the bottoms of the legs to this angle. In getting the slant on the pole it is best to hold the leg against the pole at the proper slant, then mark on both sides of the leg. The whole problem of getting this will rely on the worker, since no absolute measurements can be made. Saw down as far as necessary, then chisel out the wood. Fit on the legs and when they have enough spread at the bottom, round off the upper corners with a chisel and woodfile as shown in the end view of the drawing. Fasten the legs with two lag screws in each side. Nail on a 2x4 at the bottom, marked *A* in the drawing, then the two 8" boards directly under the pole. These are to be cut out to fit the pole before being nailed on.

TEETER



CIRCLE SWING OR REVOLVING LADDER.

This circle swing, or sort of ferris wheel, was made and used by boys living in the author's neighborhood. These boys worked out their own design and succeeded in getting a very good piece of apparatus. It may be built near to a building, thus doing away with much of the bracing shown in the drawing. A crowbar will serve the purpose of the gas pipe.

To get into the swing, one boy sits in one of the swings while the other boy climbs the ladder to get into the other swing. The lower boy pushes with his feet, starting the swing around a half circle, then the second boy gives another push, thus keeping the swing in motion.

Material.

Two pieces 3½"x5½"x12'.
Six pieces 1¾"x3½"x10'.
Two pieces 1¾"x3½"x14'.
Four pieces 1¾"x3½"x8'.
One piece 1½" round x 13'.
One piece ⅞"x3"x3'.
One piece 2" gas pipe 4'1" long for axle.
Two pieces rope 6' long for swings.
An assortment of nails.

Bill of Stock. Finished dimensions.

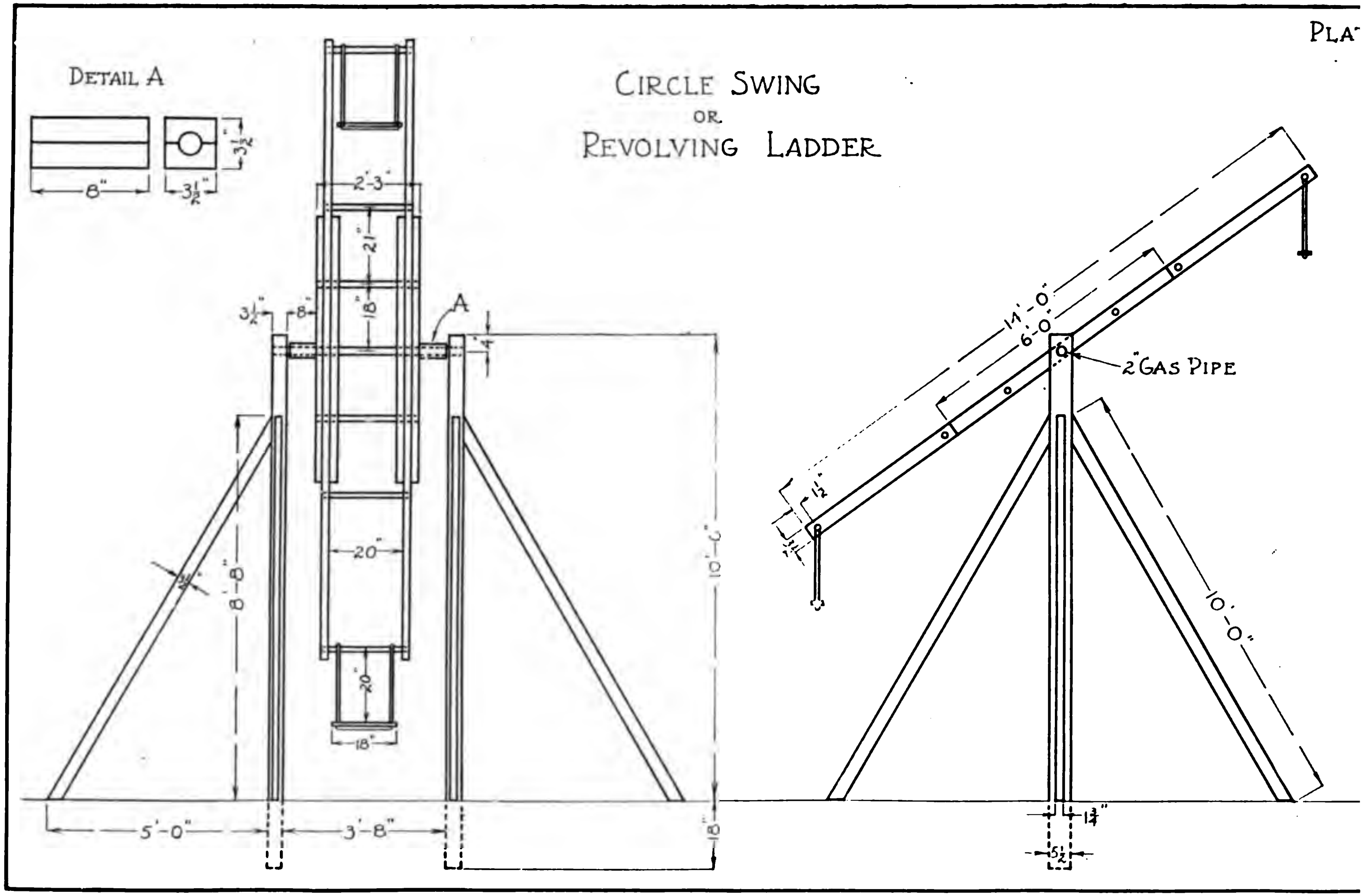
Two pieces 3½"x5½"x12' for posts.
Six pieces 1¾"x3½"x10' for braces for frame.
Two pieces 1¾"x3½"x14' for ladder.
Four pieces 1¾"x3½"x6' braces for ladder.
Four pieces 1½" round x 23½" long for ladder rungs.
Two pieces 1½" round x 2'3" long for ladder rungs.
Two pieces ⅞"x3"x18" for seats in swings.
Four pieces 1¾"x3½"x8" for detail *A*.

Tools. Saws, plane, framing square, rule, brace, extension bit, gouge, and hammer.

Working Directions. Bore a 2" hole for your gas pipe to slip thru, 4" from the end of the two upright 4x6's. Set the posts 18" into the ground and 3'8" apart. Saw the angles on the braces, using 7½" on one arm of the square and 13" on the other arm. Reverse to get the angle at the other end. Nail these braces at the upper end 8'8" from the ground. Drive stakes into the ground and nail the lower end of the braces to the stakes. Make the ladder rounds 1½" in diameter at the middle, and 1" in diameter at the ends where they fit into the ladder.

Find the middle of each 14' ladder piece. Spike the 6' braces onto each side, being careful not to put nails where holes are to be bored. Bore the middle 2" holes for the gas pipe. Lay off and bore the holes for all the rounds, noting the distances in the drawing. Slip the rounds in place and drive a stout brad thru each joint. Elevate the ladder into position and slide the 2" pipe thru. Make four pieces as shown in the detail *A* to fit around the gas pipe. These keep the ladder from sliding from side to side. When these are made nail them around the gas pipe and toenail them to the ladder. Make the seat boards for the swings 3" wide and 18" long. Bore a hole near each end to hold the rope. Fasten one end of the rope to the end round making it neat and strong; slip the rope thru the seat board, then fasten as before. Put on the swing at the other end and the project is completed.

CIRCLE SWING OR REVOLVING LADDER



FRAME FOR SWING.

This frame is a combination made for the girls, small boy and large boy. It furnishes a good swing for the girls and small boys, and a good substantial horizontal bar for the large boy. It is very excellent for the home playground in the back yard. As a problem it gives forge work in bending, welding, boring and threading. This work is done in the shop and the other work directly on the ground.

Material. Stock, finished dimensions.

Two pieces 3½"x3½"x16'.
One piece 3½"x3½"x5'.
Two pieces ⅞"x3½"x2'3".
Four pieces 1¾"x3½"x2'6".
Two eyebolts with rings, ⅝" stock.
Two pieces ¼"x1½"x16" iron.
Two pieces ¼"x1½"x8' iron.
Eight lag screws ⅜"x2".
Two dozen 2" No. 12 flat-head screws.
A quantity of No. 12 wire.

Tools. Saw, hand-ax, chisel, brace, ⅝" and 5/16" bits, wrench, pliers, screwdriver, and forge shop tools.

Working Directions. The horizontal bar attachments, eyebolts, rings and iron pieces that form upper corner braces will have to be made in the forge shop. Heat and bend the long iron which forms the rests for the bar, as shown in the detail. The bar is 2" square and the iron must be bent the right size to allow the end of the bar to slide thru. Make holes for screws in the pieces of iron just above and below each square opening for the bar.

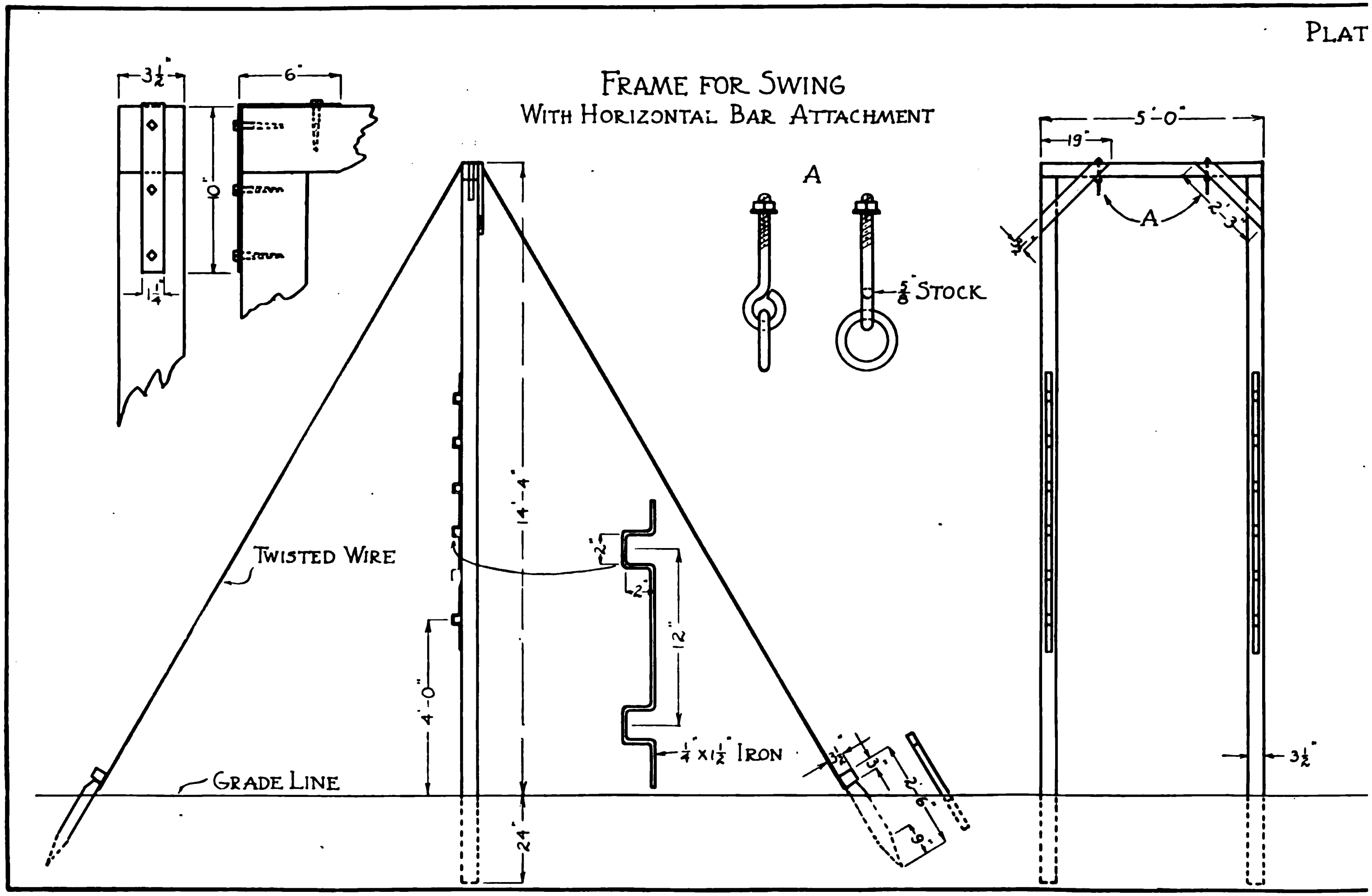
The ring should be either 3" or 4" in diameter. Turn the eyebolt, and put the ring in place, close the eye with a hammer and cut threads on the other end of the bolt. Put on a washer and nut. Four ⅜" holes are required in the two upper corner iron braces. See detail.

Put on the bar attachment before the frame is raised. Measure up 6' from the bottom of the uprights for the first bend in the iron. Set the posts 2' into the ground, thus making the bar 4' from the ground in the lowest position, raising 1' with each move, the highest being 9'.

The four stakes are made of studding 2'6" long, sharpened with a hand-ax at the lower end so that they may be driven into the ground. Make a notch on one side as shown in the drawing. Wind the twisted wire braces around the horizontal 4x4. Dig the holes and elevate the frame. Be sure the posts are plumb. Drive in the stakes and tie on the wire braces.

PLAT

FRAME FOR SWING
WITH HORIZONTAL BAR ATTACHMENT



BOY'S COASTER.

This coaster is made for the small boy. It is low, broad and not easily overturned. With a small grade, a good concrete walk, the boys will entertain themselves by the hour.

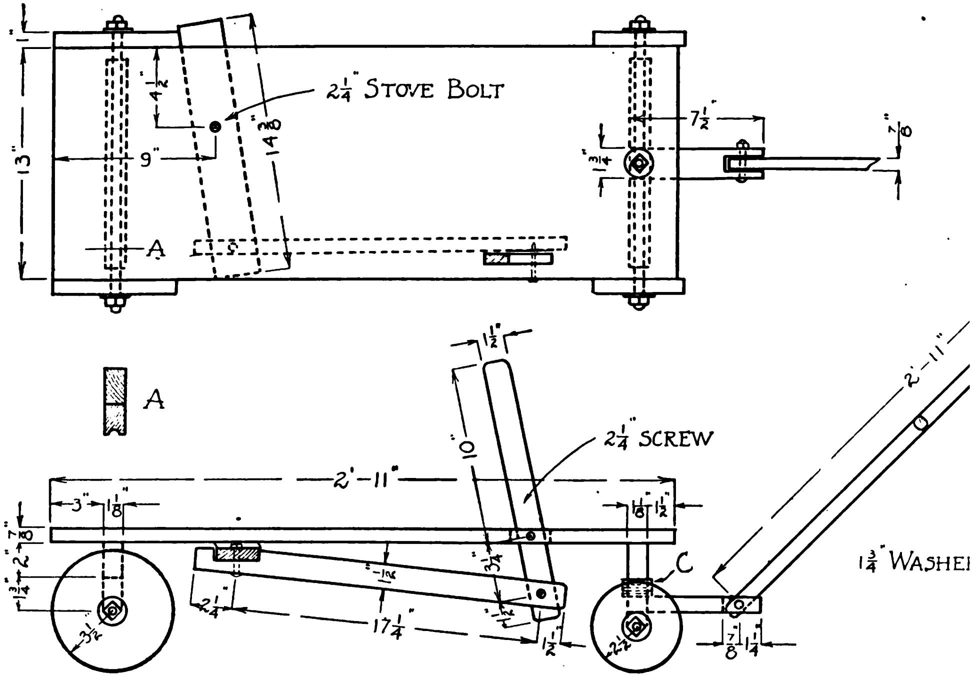
Material. Stock, finished dimensions.

One piece 1"x13"x2'11" for seat.
Two wheels 3½" radius and 1" thick.
Two wheels 2½" radius and 1" thick.
One piece ⅞"x1½"x14¾" for handle to brake.
One piece ⅞"x1½"x21" for brake.
One piece ⅞"x2½"x14⅜" for brake.
One piece ⅞"x⅞"x3' for tongue.
One piece ⅞"x1¾"x7½" for projection for tongue.
Two pieces 1⅛"x2"x11¾".
Two pieces 1⅛"x1¾"x11¾".
Two bolts ½"x16½" with four nuts and four washers.
One bolt with nut and washers ½"x6".
Three bolts 5/16"x2".
A number of 1½" screws.
Several large washers for *C*.
One 2¼" screw.
Four 1" pieces of gas pipe to fit over ½" rod.

Tools. Saw, plane, gage, chisel, brace, ½", 5/16", ⅝" and ⅜" bits, several drills, hack-saw, rule and pencil.

Working Directions. This problem has been drawn in three views and details are given in such a manner that only general directions need to be given. Make the wheels of selected red birch. Turn them out on a lathe. Bore a hole thru each wheel at the center so that the piece 1" gas pipe that has been sawed out may fit snugly into the wheel. This is to keep the wood from wearing. The axles are made of two bolts threaded at each end, with a nut and washer put on each side of the wheel.

BOY'S COASTER



STILTS.

Most boys go thru the joyful experience of walking on stilts, and they know that the stilts should be light and easily lifted while walking, and they need to be solidly built and strong. The two types are given here, the long stilts which are held under the arms, and the short ones which are strapped to the legs. The short stilts are somewhat dangerous for the boy who has not first learned well to use the long ones.

Material. Held under arms.
Two pieces 1¼"x1¼"x6'9". Yellow pine.
Two pieces 1¼"x3¾"x8".
Two pieces of leather strap about 12" long.
Ten 1½" No. 10 screws.
Some gilt or brass-headed tacks, nails.

Tools. Saws, plane, wood-file, brace, ⅜" bit, drill, screwdriver and hammer.

Working Directions. Rip and plane the two long pieces from a good straight grained studding. Make these pieces square up to a height of 2'2", but plane off and round the corners from this point to the top of the stilts.

Use an extra wide piece of studding, or a 2x6, in making the foot supports. Cut these to dimensions, sawing off the lower corner to make the stilt lighter and better appearing. Screw these foot supports onto the uprights. Since the screws will not reach thru the uprights and fasten well into the supports, holes large enough to admit the screwhead must first be bored into the uprights to within ¾" from the inner side. From this point bore a smaller hole thru which the screw shank slides, to fasten into the foot supports. Make all these sets of holes first, place the support in position and set the screws. Tack on the leather with brass-headed tacks. Leave plenty of room to remove the feet quickly in case of a fall while learning to walk. Beginners in the art of stilt walking should fasten the foot rests low at first, moving them higher as walking becomes easier.

The construction of the second pair of stilts is evident from the drawing; the only difference being the leather strap with buckle.

SCOOT.

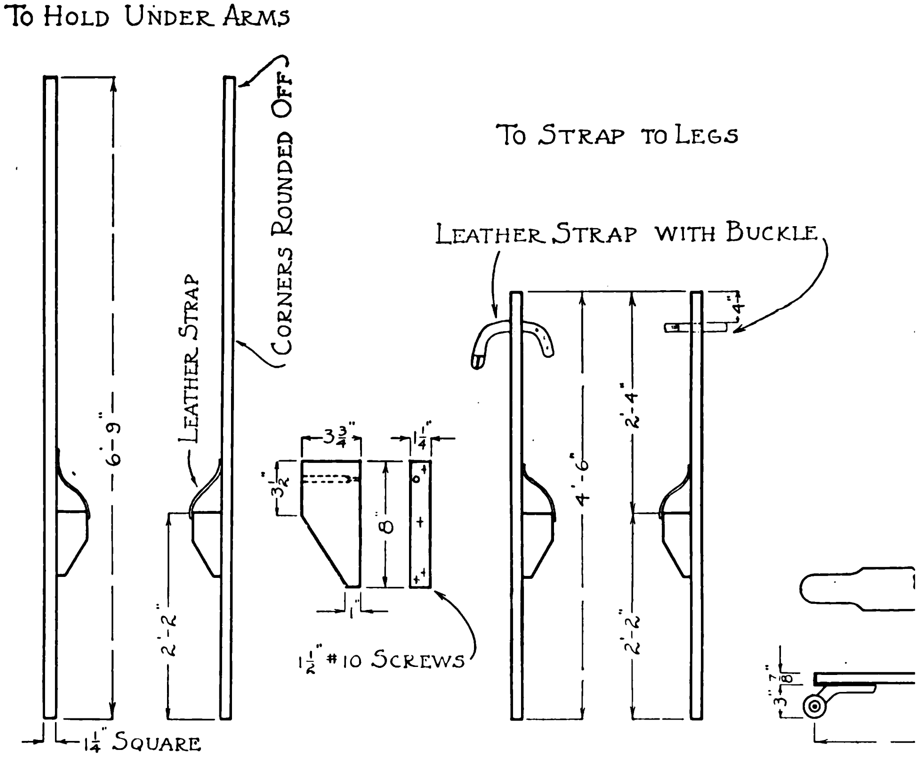
How light hearted and happy is the boy's response when mother asks him to go erranding, if he has a smooth-running scoot to speed him on his trip. And how much earlier does he get home from school if a playmate as faithful and as joy-giving as this one awaits him. A box nailed over the back wheels furnishes a good holder for parcels and schoolbooks.

Material.
One piece ⅞"x3½"x7'.
One old roller skate.
A number of 6d nails.

Bill of Stock. Finished dimensions.
Two pieces ⅞"x3½"x2'3".
One piece ⅞"x2"x15".
Three pieces ⅞"x1¼"x12".

Working Directions. It is scarcely necessary to tell how to put the woodwork together since it is so simple. The rear end should be rounded as shown in the drawing. This is done in most cases to make it fit the skate. The most important thing in this problem is to get the wheels to "track." They must be directly behind each other or they will not run straight.

STILTS


TO HOLD UNDER ARMS
CORNERS ROUNDED OFF
LEATHER STRAP
6'-9"
2'-2"
1¼" SQUARE
3¾"
1¼"
3½"
8"
1"
1½" #10 SCREWS
TO STRAP TO LEGS
LEATHER STRAP WITH BUCKLE
4"
2'-4"
4'-6"
2'-2"
3"
7/8"

CHILD'S JUMPING BOARD.

This makes a fine plaything for the little boys and girls just beginning to learn to handle themselves. It is safe for the toddling babies, and yet a thing suitable for children much older. It is scarcely stout enough, however, for very rough, heavy play.

Bill of Stock.

One piece ⅞"x12"x3' for base board.
One piece ⅞"x12"x3'2" for top. Elm or any springy wood.
One piece ⅞"x3¼"x12" for brace.
One piece 1¾"x2½"x12" for *A*.
One piece 1¾"x3½"x12" for *B*.

Tools. Saw, hammer, plane, gage, and T-bevel.

Working Directions. Cut all pieces to dimensions given in the bill of stock. Set the gage to 1¼" and gage one edge so that when planed off piece *A* will be 1¾" on one edge and 1¼" on the other, as shown in the drawing. This furnishes the slant for the springboard. Set the T-bevel to this slant and plane an edge on piece *B*. Plane off the back piece so that it will correspond to the slant of the top. Nail the top and bottom boards to piece *A* securely; then nail on the piece at the back. This last piece will hold more securely if put on with screws. Piece *B* should be nailed to the top piece but left loose at the bottom to give more spring to the board.

BOOMERANG.

The first boomerang was an Indian weapon, and was thrown at the enemy or at the animal to be killed in much the same manner as the tomahawk was thrown. The boomerang of today is used as a source of entertainment to the thrower, and it is entirely different from the Indian boomerang in that it is merely thrown into the air, where it makes a turn and comes home to the thrower.

Bill of Stock. Basswood.
Two pieces 3/16"x1"x14".

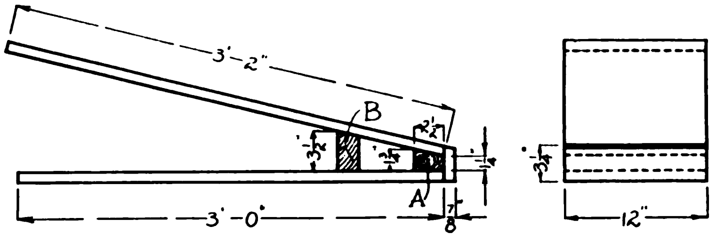
Tools. Saw, plane, and good sharp pocketknife.

Working Directions. After the pieces have been planed to width and thickness they should be put together at the middle to form a cross lap joint. Before gluing, the under side and front edge of each arm should be whittled off as shown by the dotted lines and by sections at *A* and *B* in the detail. Glue the two pieces together.

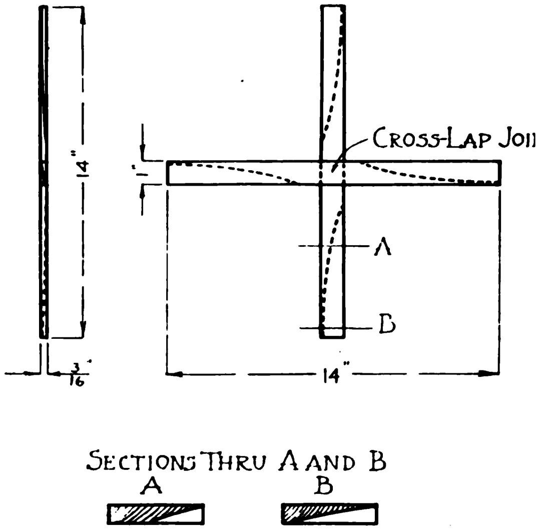
To throw the boomerang grasp one of the arm ends between the thumb and forefinger of the right hand and throw horizontally, much as you would skip pebbles on the water, the flat edges of the boomerang being upward. The boomerang is thrown forcibly, the piece whirls, the arms or blades cutting the air tend to turn the boomerang upward. After the force of the throw has become somewhat spent, the blades cutting the air overcome the force and turn the boomerang upward and backward. A few trials and the thrower should be able to throw the boomerang in such a manner that it will turn in the air and return to him.

PLAT

CHILD'S JUMPING BOARD



BOOMERANG



SLUNG-SHOT HANDLE.

Every boy seems to go thru the stage of the warpath, and in his younger days when his parents are wise enough to keep firearms away from him, he usually resorts to the slungshot or bow and arrow. The slungshot here shown makes a good shop problem. It is convenient, since it may be easily slipped into the trousers or coat pocket, and it does not make an uncomfortable bunch.

Material. Finished dimensions.

One piece of straight grained wood ¾"x2½"x5¼" when finished.

Tools. Coping saw, plane, compass, knife, pencil, gage, and wood-file.

Working Directions. Measure up 2" from one end and with trysquare and pencil draw a line around the entire piece. From this line taper the other end of the piece to ⅜" thick. Before proceeding further all the laying out must be done. A line has already been drawn across the piece 2" from the end; draw another $1\frac{7}{16}''$ farther up. Between these two lines lay out the double curves to shape the handle. To finish the shape of the handle set the gage at $1\frac{3}{16}''$ and gage lines from the ends of the double curve just made down to the lower end of the piece of wood. To shape the prongs, set the pencil gage at ⅜" and gage lines from the upper line on both sides to the end. Shape the inner curves of the fork. Cut to these lines with a coping saw. With a pocket knife whittle the lower handle to an ellipse, and round off the corners on the entire piece. Make notches on both prongs, down about ¼" from the end as shown in the drawing. File the rough places and sandpaper all smooth. Put on a coat of varnish, or stain or orange shellac to keep the wood from getting soiled.

Two rubber bands, some string and a small piece of thin leather will complete the slungshot. A pocket full of smooth round pebbles and you are ready to storm the enemies' trenches. But boys, remember the beautiful song birds are your friends. Protect them always.

BOW AND ARROWS.

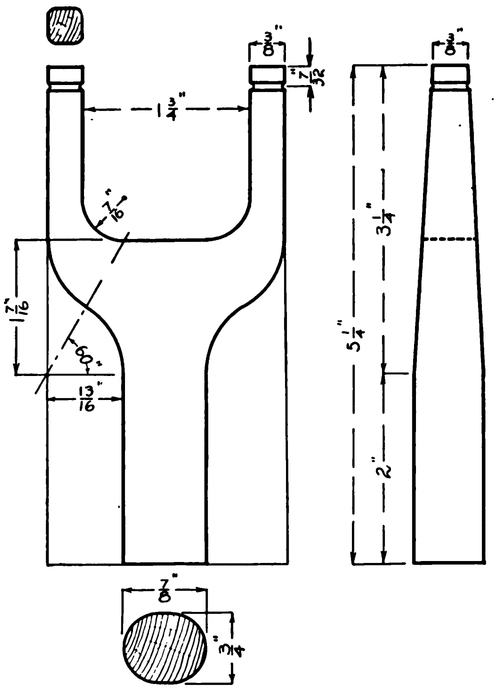
Material. Mulberry, sassafras, black walnut, apple or most any straight grained wood may be used for this bow. The piece must be ½" thick, 1" wide, and 5' long.

Directions. This bow is ½" thick in the middle and tapers down to ¼" thick at each end. It is 1" wide in the middle and ¾" wide at each end. Cut a notch 2" from each end to hold the loop end of the string. Sandpaper till smooth and thoroly rub in linseed oil. It is better to oil it several times. Glue on a piece of velvet about 3" wide around the center of the handle. This is to protect the hand while drawing the bow.

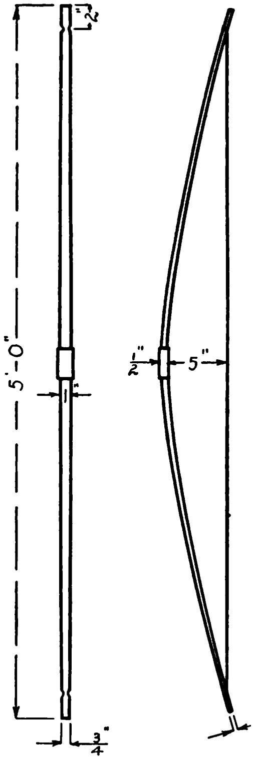
The bow string is made of cotton. Make a loop in the end of the string as shown in the detail; put the loop over the notch; bend the bow until the string is 5" from the handle and attach the loose end to the lower notch by means of a slip knot.

The arrow shafts should be 24" long and for a 5' bow. Whittle them out of straight grained strips of wood, round them nicely and cut notches in the ends large enough to fit over the bow string. There are several ways of making the head, three ways being shown in the detail of the drawing. One good way is to cut a thick piece of zinc or lead in somewhat the same shape as the original Indian arrow heads, and put onto the shaft the same way, that is cutting a notch in the end of the shaft, slipping in the piece of zinc or lead, then tying with stout threads. Another way is to slip a hardwood head into the slot made in the shaft. Still another way is to drive a nail in the end of the hard wood head and file the nail head off.

SLUNG-SHOT HANDLE



B



WHIP BOW.

The whip bow appears in some localities as regularly in its season as do marbles, tops and kites. This form of bow is found more often. It was in common use in and around the author's old home near St. Louis. The bow is made of any good green stick about 3'8" long, and a piece of good heavy wrapping cord about half as long, knotted at the end. The small boy may prefer a shorter bow.

The arrows are made of redwood or cedar shingles, and may easily be worked out by following the drawing. Success may not come in making the first arrow, since the shingles split easily, but after a few attempts the operation will be easy. Notice that the notch is placed diagonally across the arrow. This makes it easier to keep the knot of the string in place.

Whittle out your arrows with a pocket knife, using a rule at first to be sure to make good proportions. After a little practice you will be surprised to know how far you can throw an arrow.

I shot an arrow into the air,
It fell to earth, I knew not where,
For so swiftly it flew, the sight
Could not follow it in its flight.

THROW STICK.

The manner of throwing arrows with this kind of a stick is not so well known, but the author has seen it used with considerable success. A board is whittled and shaped to resemble the drawing. The size of the handle at *A* should be such that the hand may easily hold it, and also allow the thumb and first finger to grasp the shaft end of the arrow.

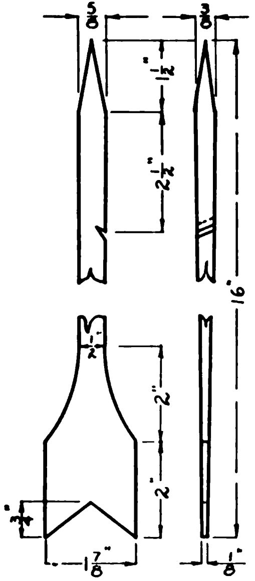
Shape a piece of hardwood so that it will project out as shown in the drawing, and wrap it securely in place with strong cord or fine wire. The arrow consists of a straight stick with a lead tip at the end. Detailed drawings showing how to make the tips are found on Plate 32. At the shaft end of the arrow, ream out a small hole just large enough to allow the projection of the throw stick to fit into it.

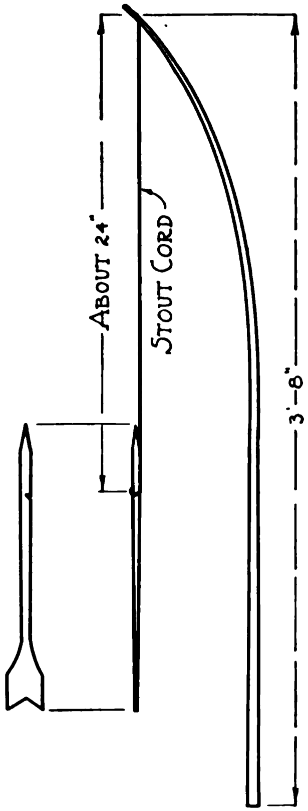
To use the throw stick, grasp the handle *A* in the right hand. Set the shaft end of the arrow over the projection, hold the arrow shaft between the thumb and fore finger, draw the arm back over the shoulder and drive the hand forward as sharply as possible, releasing the arrow from the thumb and finger at the proper time. The handle adds length to the arm and gives much added force to the throw.

PLA

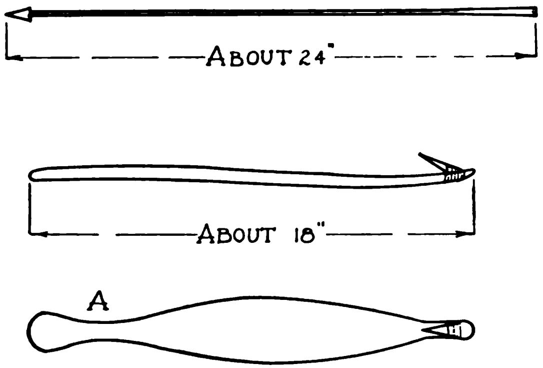
WHIP BOW

DETAIL OF ARROWS





THROW STICK



SKEES.

Skee running and jumping is one of the favorite winter sports in Norway and Sweden and it is growing steadily in favor in the northern parts of the United States, and in Canada.

The author has had students who were very enthusiastic about the sport, and who rode many miles to see the skee tournaments. A long incline with a good snow covering, and a good pair of skees will give continual enjoyment during the winter weather.

No. 1.

Material. Finished dimensions. Hickory, oak or other hard wood.

Two pieces ¾"x4"x7'.
Two pieces ¾"x3½"x12".
Two pieces leather thong.
Eight screws 1¼" x No. 9 flat-head.
Two leather straps.
Four staples.

Tools. Plane, draw knife, saws, chisel, brace and small drill for screws, and screwdriver.

Working Directions. If desired, plow two grooves in a straight line $\frac{1}{16}$" deep and ¼" wide on both skees as shown in detail *A*. This will hold the skee runner on his course. On one of the long pieces, measure in 2'10" and draw a line across, measure 16" further, then 24" and draw lines. The 16" space at the middle is left full ¾" thick. At the rear end, plane the piece until it tapers down to ⅜". Taper the front end down to about the same thickness, or to ½" at a point 10" from the end as shown in the drawing. Lay off the point on the front end and with the draw knife shave down to the line. The front end is now bent up by steaming or boiling, and bending until the proper pitch and curve is obtained. To hold this curve it is well to drive in two staples, and fasten the leather thong or piece of wire to hold it in place as shown in the detail. It would be well to let this remain on all the time if the curve is great. If the curve is small allow the wire or thong to remain in place until the wood has thoroly dried.

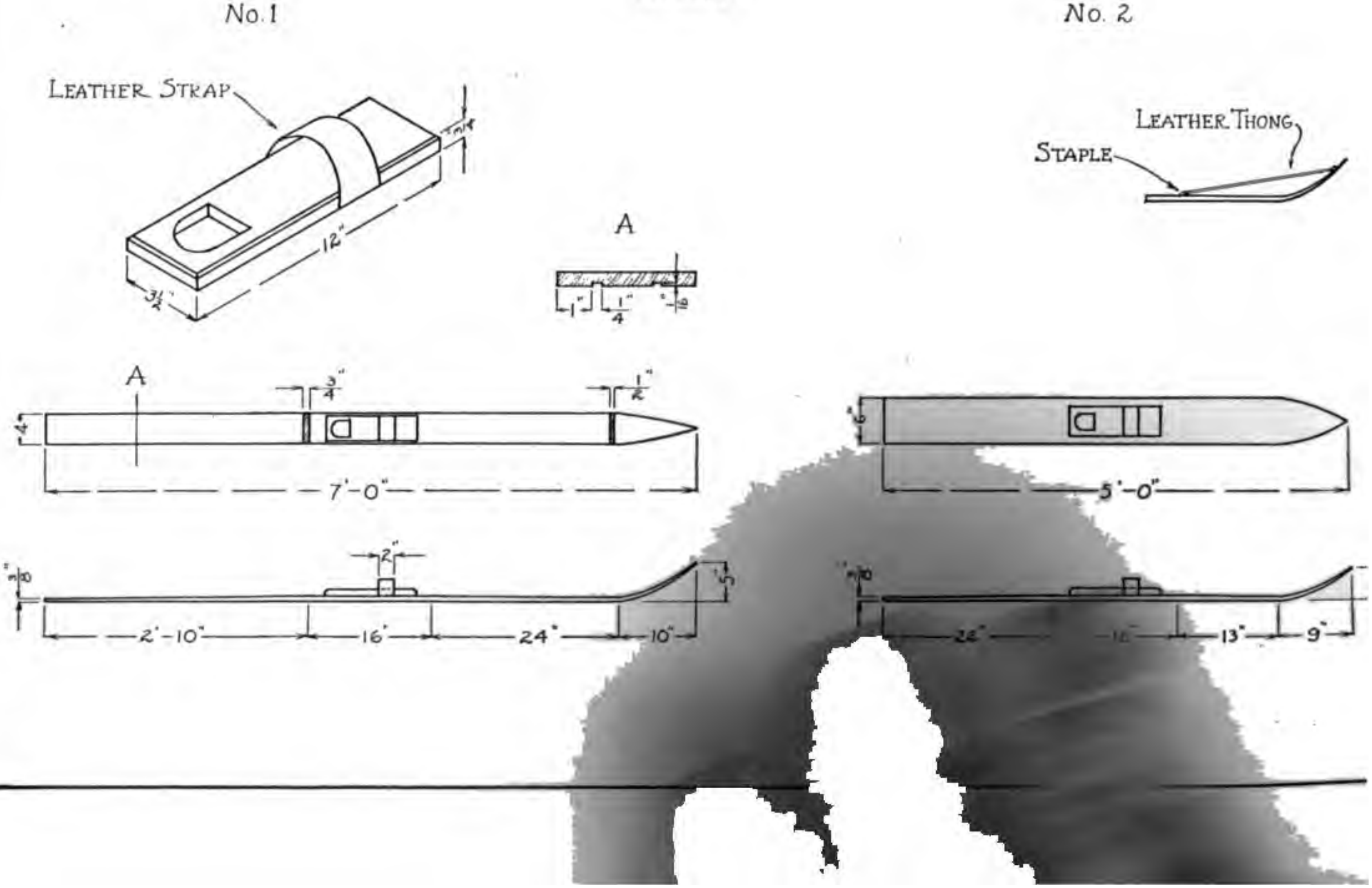
A foot block as shown in the detail is attached in the middle by four screws. You will notice that a small opening to fit the heel is chiseled into the block. Cut a groove on the under side of the block to receive the leather strap. This leather strap may be tacked on altho a strap with a buckle is much better, since it can be tightened or loosened at will.

No. 2.

This skee is similar to the other except that it is 6" wide and 5' long. This will be better for the small boy since it is safer.

PLA

SKEES


No. 1
LEATHER STRAP
3/4"
12"
3½"
A
A
1"
1/4"
1/8"
3/4"
1/2"
4"
7'-0"
2"
3/8"
5"
2'-10"
16"
24"
10"
No. 2
LEATHER THONG
STAPLE
6"
5'-0"
3/8"
22"
16"
13"
9"

THE SKEE SLED.

This model is different from the ordinary sled in that the runners are made in the form of skees. It is made low and broad so that it will not tip easily.

Material. Straight grained ash.
Four pieces ⅞"x6"x14'.
One piece 1¼"x6"x4'.
Six bolts ¼"x8".
A number of 8d and 10d common nails.

Bill of Stock. Finished dimensions.
Two pieces ⅞"x6"x10' for runners.
Four pieces ⅞"x6"x7' for seat boards.
Three pieces ⅞"x2"x2'2" for crosspieces.
One piece ⅞"x2"x2'6" for front crosspiece.
Four pieces 1¼"x5½"x8" for blocks.
Two pieces 1¼"x6"x8" for blocks.

Tools. Saws, chisel, plane, rule, square, pencil, gage, hammer, brace, ¼" bit.

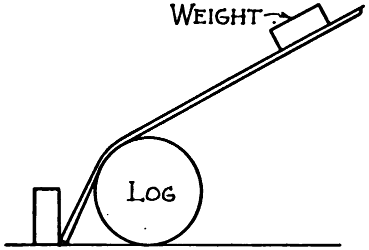
Working Directions. Make the skee runners first. To make the wood bend easily, plane off about ¼" on the upper side at the point of bending, but do not plane the ends for the present. Steam the ends of the runners if possible. If this is inconvenient, boil at least 18" of the ends to be curved, in water. Cover as tightly as possible and boil for one hour or longer. When the skees are taken from the water, quickly place them side by side in the bending device you have previously arranged. Bend with a slow even pressure, and put a weight at the top. Leave them thus for eight or ten hours, depending upon the drying conditions of the atmosphere. When dried, sharpen the ends.

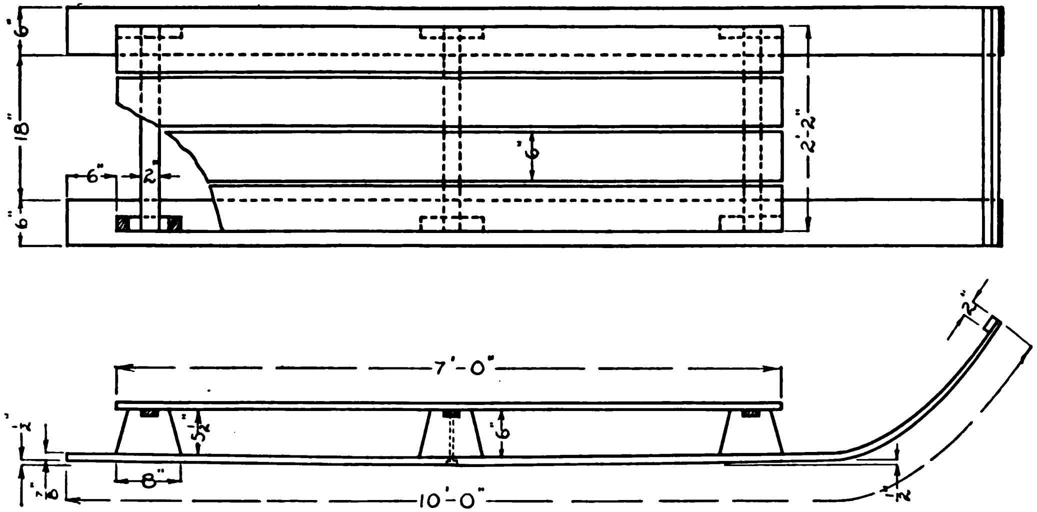
Notice in the drawing that the middle upright blocks are 6" high and the end blocks are 5½" high. This gives the sled a rocker curve, making it run more smoothly. Make these blocks to dimensions given in the drawing, sawing and chiseling out the 2" notches for the crosspieces. Place the crosspieces in position and bore holes for the bolts. Put a ¼" flat head bolt thru the skee, the block, and the cross piece, counter sinking the holes for the heads of the bolts.

The top is made of 6" boards nailed or screwed to the crosspieces. Finally put on the front cross strip to brace the ends of the skees.

PLA

SKEE SLED





TOBOGGAN.

Toboggans are more common in the northern parts of this country and Canada. A long smooth hill affords an excellent toboggan slide when well covered with snow, and particularly so when it is possible to flush it with water and make a smooth hill of ice. The toboggan is in high favor under these conditions, and the one given here possesses the necessary qualities of lightness and strength.

Material. Finished dimensions. Hickory, oak or birch.
Eleven pieces ¼"x1½"x8'6".
Two pieces ¼"x1¾"x8'6".
One piece ¼"x2"x20".
Two pieces ¾"x1"x5'4".
Three pieces ¾"x2"x20".
One piece ¾"x2"x23".
Six pieces 1"x1"x2".
About 5' of rope and some cord to tie the ends.
Two dozen 1" No. 9 flat-head brass screws.
Six copper rivets or bolts with washers ¼"x4".
Twenty-six ½" flat-head brass screws.

Tools: Saws, plane, brace, ¼" bit, small drill for screws, screwdriver.

Working Directions. The bottom boards are held together by five crosspieces. The first crosspiece is set in 6" and the next two are 2'4" apart. The crosspiece at the front end is 3" longer than the others and is fastened on the underneath side of the curved board runners. The boards should be fastened on with brass screws or copper rivets, having the heads countersunk from the bottom.

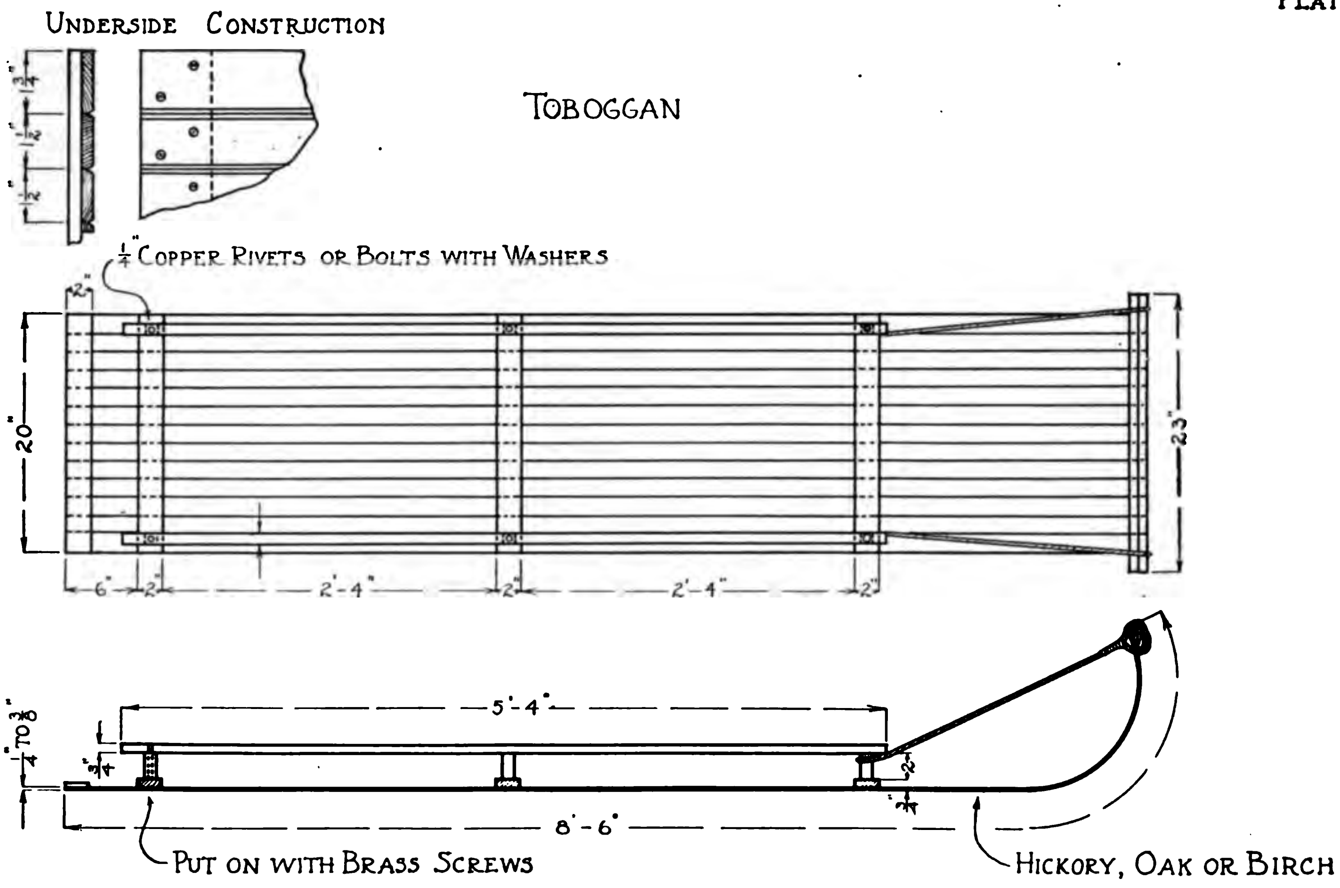
Make six pieces 1"x1"x2" for the uprights and bore a ¼" hole thru each one from end to end. The hand rails are ¾"x1" and should be made of hickory. Round off the corners so they cannot hurt the hands. Attach these rails to the toboggan with copper or iron rods, using either washers or burrs on the rod ends; or you may use long stove bolts. Countersink these on the under or runner side, tighten well, and file the tops off smooth.

Cut notches in the projecting front stick so that ropes can be tied fast to the stick.

Cut the runner boards into narrow strips. This eases the jolt which rough and uneven places in the road will give the toboggan. Only one or two narrow boards "give," instead of jolting the entire width. Plane the edges of each of the thirteen runner boards as shown in the detail of underside construction. This aids in guiding the toboggan.

Steam the runner boards between the front end and the first crosspiece, or pour boiling water over both sides of the boards; then bending the wood upward and tightening the ropes to hold the boards in place, keep wetting until the proper curve has been made. If it does not curve easily, bend it over a log, or a piece of some kind as shown in Plate 35. Tie the ropes fast, and let the wood dry. Then sandpaper smooth and give it several good coats of varnish.

PLAT



TOBOGGAN

BOB SLED.

What boy will not revel in the possession of a well-made bob sled, and particularly one he has made himself. The model given here is as strong as wood and bolts can make it, it is not too heavy, and it guides well.

Material. Hard Wood.

One piece 1"x12"x14'.
One piece 1¼"x10"x9'.
One piece 1½"x3½"x12".
One piece ½"x3"x7'.
One piece 3½"x3½"x9½".
Two wheels 2" in diameter.
One bolt ¾"x14".
One bolt ¾"x6".
Four bolts ⅜"x5".
Two bolts ⅜"x3½".
About 11' of 5/16" cotton rope.
An assortment of nails.
Four pieces thin iron 1" wide and 3' long for runners. The iron used on the top edges of wagon boxes is very convenient for this purpose.

Bill of Stock. Finished dimensions.

One piece 1"x12"x7'3" for reach board.
Four pieces 1¼"x5"x2'8" for runners.
Four pieces 1¼"x2"x14½" for crossbraces for runners.
Two pieces 1"x14½"x21" for tops for sleds.
One piece 1"x2"x18" crosspiece on front runner.
One piece 1½"x3½"x12" for *B*.
Three pieces 1¼"x1½"x20" for foot rests.
Two pieces ½"x1¼"x7' for guard rails.
Two pieces 1¼"x3"x9" for *D*.
One piece 3½"x3½"x9½" for *E*.
One piece 1"x2"x2'5" for *F*.

Tools. Saws, plane, gage, rule, turning saw, knife, brace, 5/16", ⅜" and ¾" bits, chisel, draw-knife, spokeshave, and hammer.

***Working* Directions.** Lay out the sled runners and work down to the lines. Lay out the shape of one front and one back piece carefully, cut down to lines and use each as a pattern for the opposite runner. Make four pieces, *A* in detail, for the crosspieces on the runners. To lay out the notches in the runners into which the above crosspieces are to be fitted, hold the end of the crosspieces carefully in position and with a knife mark on both sides of the joint. Set the gage to the width of the crosspiece and gage for the depth of the notch. Saw down to this line and chisel out the wood. After all have been made, screw on securely into place. Put the iron pieces onto the bottom of the runners. Put on the tops of the sleds with screws. Bore a ⅜" hole in the front piece, marked "bit" in the drawing, and screw it on. Piece *B* may be easily constructed by noting the detail. Place *B* on the front sled so that the centers of the holes are back 11" from the front end of the board. Put in the two small bolts, but not the large one. The back piece that raises the reach or seat board is 3½"x3½"x9½" with a ¾" hole bored thru from end to end. Bolt this piece to the rear sled.

Round off the front corners of the reach board. Make three pieces marked *C* in the detail to fit underneath the reach board. Put these on with screws from beneath.

Piece *F* has a wheel at each end which makes guiding easier. Cut a slot in each end of *F* wide enough to allow the wheels to slide easily into place. A nail or rivet will furnish an axle for the wheel to turn on. Put this piece on with screws. Cut out and nail on the guard rail. Make two pieces like *D* in the drawing, and fasten them securely to the reach, or seat board. These two pieces (with the 3½"x3½" piece) join the reach board to the back sled. The hole thru these pieces should be made low enough down so that there will be ¼" to ½" between the top piece *E* and the reach board.

Bore a ¾" hole thru the reach board at the front end to hold the large bolt which was left out of piece *B* in earlier operations. Be sure to have the smooth side of the bolt on

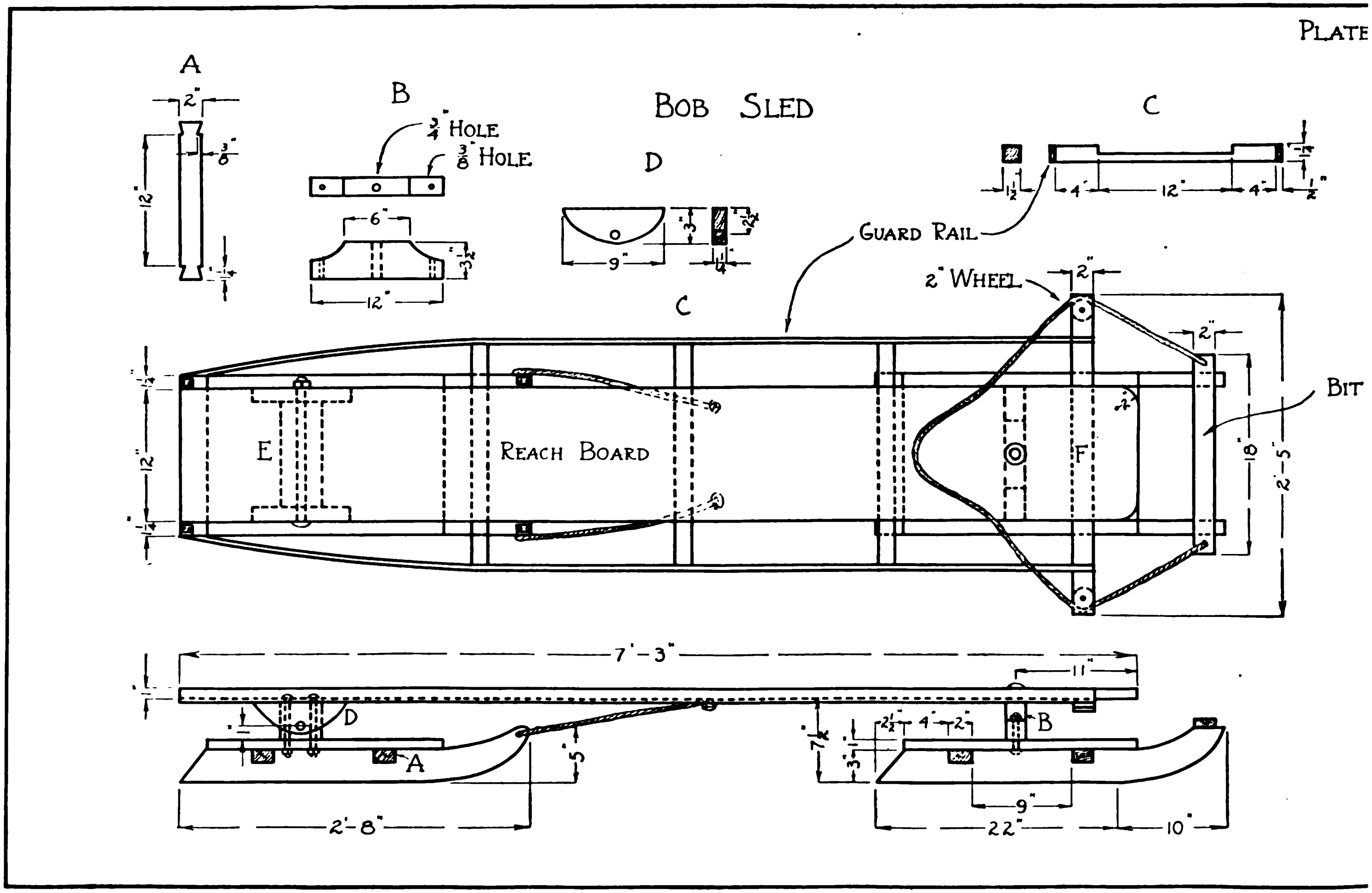


PLATE
BOB SLED
A
2"
3/8"
12"
1"
B
3/4" HOLE
3/8" HOLE
6"
3 1/2"
12"
D
3"
2 1/2"
9"
1/4"
C
1 1/2"
4"
12"
4"
1"
1/2"
GUARD RAIL
C
2" WHEEL
2"
2"
BIT
18"
2'-5"
12"
1"
1"
E
REACH BOARD
F
2"
7'-3"
11"
1"
D
B
A
5"
7 1/2"
2 1/2"
4"
2"
3 1/2"
9"
2'-8"
22"
10"

the top side of the sled. Slide the long bolt at the back into place. Bore holes in the back runners for the rope shown in the drawing, and drive two staples in the reach board to hold the ends of the rope.

CHILDREN'S PLAYHOUSE.

This playhouse has been designed for two purposes, first to furnish a good outdoor playhouse for the little folks; second as a manual training model which gives all the important processes in ordinary house building. This may be made full size and used as a playhouse or it may be made half size and used as a building model. Each step has been shown in detail so that very little difficulty should be experienced in working out the building. A bill of stock will accompany each of the different parts of the building: the foundation and platform, frame, window frame, door frame, inside and outside finishing.

Material for entire building.

Two pieces 2"x6"x10'.
Seven pieces 2"x6"x8'.
Twenty-nine pieces ⅞"x4"x10' flooring.
Seven pieces 2"x4"x8'.
Fifteen pieces 2"x4"x10.'
Thirteen pieces 2"x4"x12'.
Twenty-three pieces ⅞"x6"x10' for roof boards.
Twenty-five pieces ⅞"x4"x14' for ceiling.
Four and one-fifth bundles of shingles.
Thirty-five pieces 4" siding 14' long.
Thirty-six pieces ¾"x8"x14' shiplap.
Ten pieces ¾"x12"x14' finishing.
Eight pieces ¾"x8"x14' finishing.
One piece stool 5' long.
One piece dripcap 5' long.
Thirty-six feet molding for cornice.
Fifty feet of quarter round.
One door 2'6"x5'.

Foundation and Platform.

Bill of Stock. Finished dimensions.

Two pieces 2"x6"x9'10".
Six pieces 2"x6"x7'10".
Twenty-nine pieces 4" flooring 9'10" long.
Two pieces 2"x4"x7'10".
Two pieces 2"x4"x5'10".
Six pieces 6"x6"x18" of wood, concrete, or stone.

Tools. A saw, hammer, spirit level and framing square is all that is needed for this work.

Working Directions. Cut the pieces to the dimensions given in the drawing. Lay off and set the foundation pieces, making sure that they are all level. Nail together the 2x6's as shown in the drawing and nail them flush with the foundation. Nail on the flooring, then the four 2x4's around the edge.

Frame.

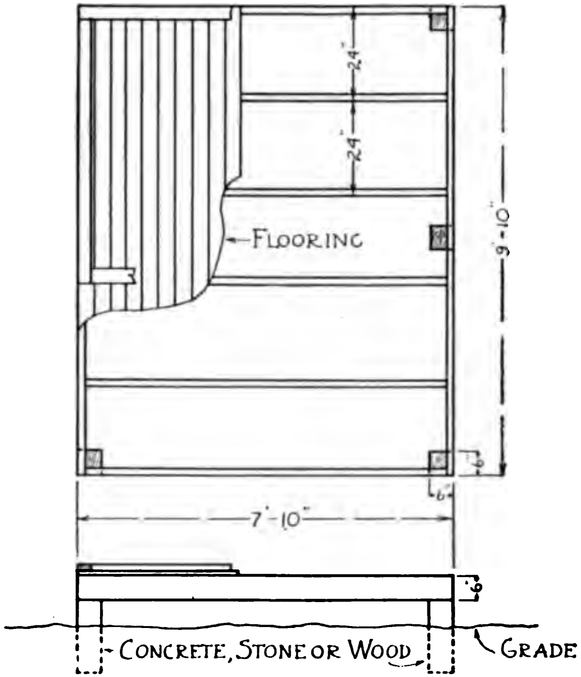
Bill of Stock. Finished dimensions.

Eighteen pieces 2"x4"x5'10¼" for uprights, corner posts, etc.
One piece 2"x4"x2'6" for above door.
Four pieces 2"x4"x20" for above and below windows.
Two pieces 2"x4"x9'10" for plates.
Two pieces 2"x4"x9'3" for plates.
Two pieces 2"x4"x7'10" for plates.
Two pieces 2"x4"x7'3" for plates.
Five pieces 2"x4"x8'4" for long rafters.
Five pieces 2"x4"x5'3" for short rafters.
Five pieces 2"x4"x9'10" for ceiling.
Two pieces 2"x4"x23".
Two pieces 2"x4"x18".
Two pieces 2"x4"x15".
Two pieces 2"x4"x8".

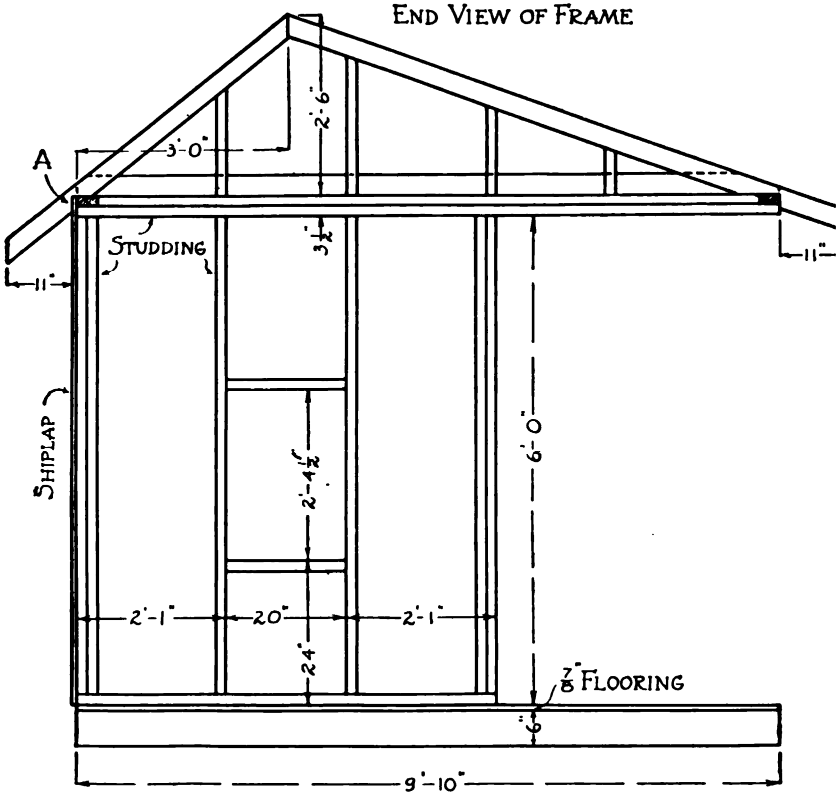
PLA

CHILDREN'S PLAYHOUSE

FOUNDATION AND PLATFORM



END VIEW OF FRAME



Working Directions. Little need be said as to the construction if both front and end views of the frame are studied carefully. Care must be taken to get the corner posts plumb. To do this, test with a spirit level before nailing on the plates. An objection may be raised to the manner of lapping of the plates on the corner posts, but this method is in general use. Toenail the upper 2x4's together firmly. When cutting the short rafters ⅞" must be allowed at notch *A* for the shiplap. Saw out the 2x4 at the lower part of the door frame after the frame has been erected. When cutting the rafters make a pattern first and mark the others by this pattern.

Cover the entire outside with shiplap, leaving openings for the windows and door. If you do not care to plaster the house, cover the inside with shiplap also, tack muslin or cheese cloth over this, and then paper. Or, you may use the so-called plaster board, Beaver board, or Compo board, instead.

WINDOW FRAMES.

Make 2.

Bill of Stock. For one frame.

(1) Two pieces ⅞"x5¼"x2'4½".
(2) One piece ⅞"x5¼"x18¾".
(3) One piece 1¾"x6¾"x18¾".
(4) One piece stool 2'6" long.
(5) One piece ⅞"x5¼"x2'6" for apron.
(6) Two pieces ⅞"x5¼"x2'1" for inner casing.
(7) One piece ⅞"x5¼"x2'6" for inner upper casing.
(8) Two pieces ⅞"x5½"x2'2" for outer casings.
(9) One piece ⅞"x5½"x2'6" for outer upper casing.
(10) One piece dripcap 2'6" long.
(11) One piece molding 2'6" long.
(12) One piece window stop 6'10".
(13) One sash.

Working Directions. The pupil, if not familiar with the making of a window will find it profitable to look at one before beginning work, since there are several things to consider. Only the frame of the window, Nos. 1, 2, 3, in bill of stock, is put in when the house is built, the outside and inside casing being left until the window is put in. The sill is given the pitch of 1" to 6" and the two edges are planed off to conform to this angle. At the outside and bottom of the sill a groove has been plowed out to allow the siding to project up into the sill to keep out wind and rain. When the window jamb is nailed together, it is set or fixed permanently into the window opening, projecting out enough so that the piece of siding will just fit up into the groove of the sill, and the sill will come flush with the shiplap on the inside. This should be put in accurately with the level. There being no weights in this window, no space between the boards and the studding has been allowed. The outside casings are put on, including the dripcap and molding beneath. Bend a piece of tin and tack it above the window so that one edge runs up under the siding, that is to be put on, and the other edge lies on the drip cap. This prevents rain from being blown up underneath the siding. The inside trim which includes first the stool, then the apron, two upright casings, and upper casing are put on to finish the window on the inside.

Door Jamb.

Bill of Stock.

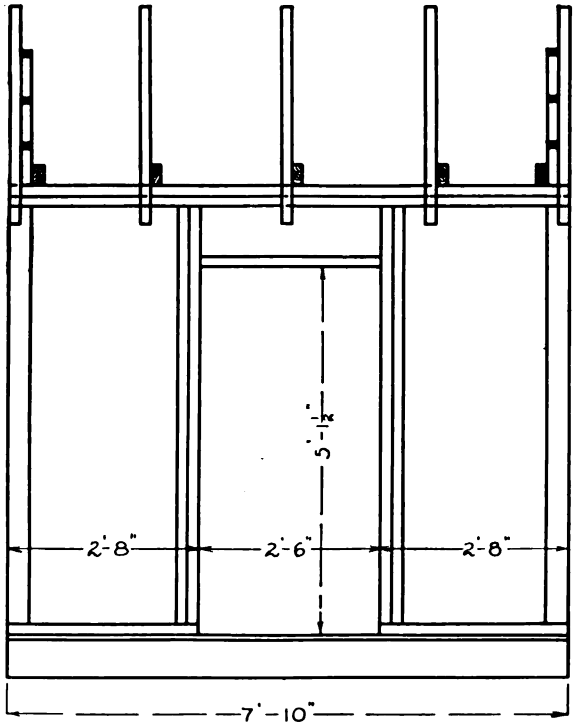
Two pieces ⅞"x5¼"x5'1½".
One piece ⅞"x5¼"x2'5".
Four pieces ⅞"x5½"x5'1½" for outside casing.
Two pieces ⅞"x5½"x3'5" for outer and inner casings.
One piece ¾"x4"x2'6".
One piece door stop 12'8" to make three pieces.
One door 2'6"x5'.

Working Directions. The door frame is made and put in the same way as the window, the three pieces being nailed together, and then nailed permanently into the opening. The casing is put on and then the door.

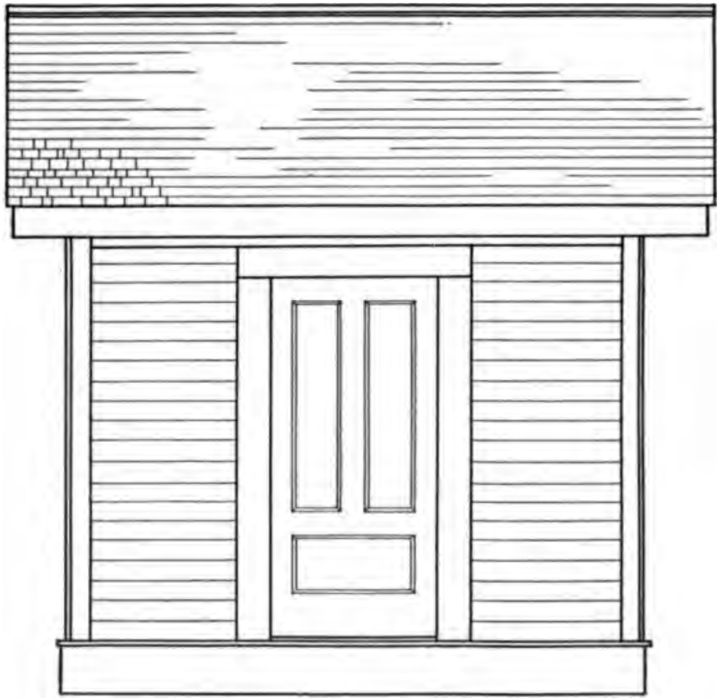
PLATE 3

CHILDREN'S PLAYHOUSE

FRONT VIEW OF FRAME



FRONT ELEVATION



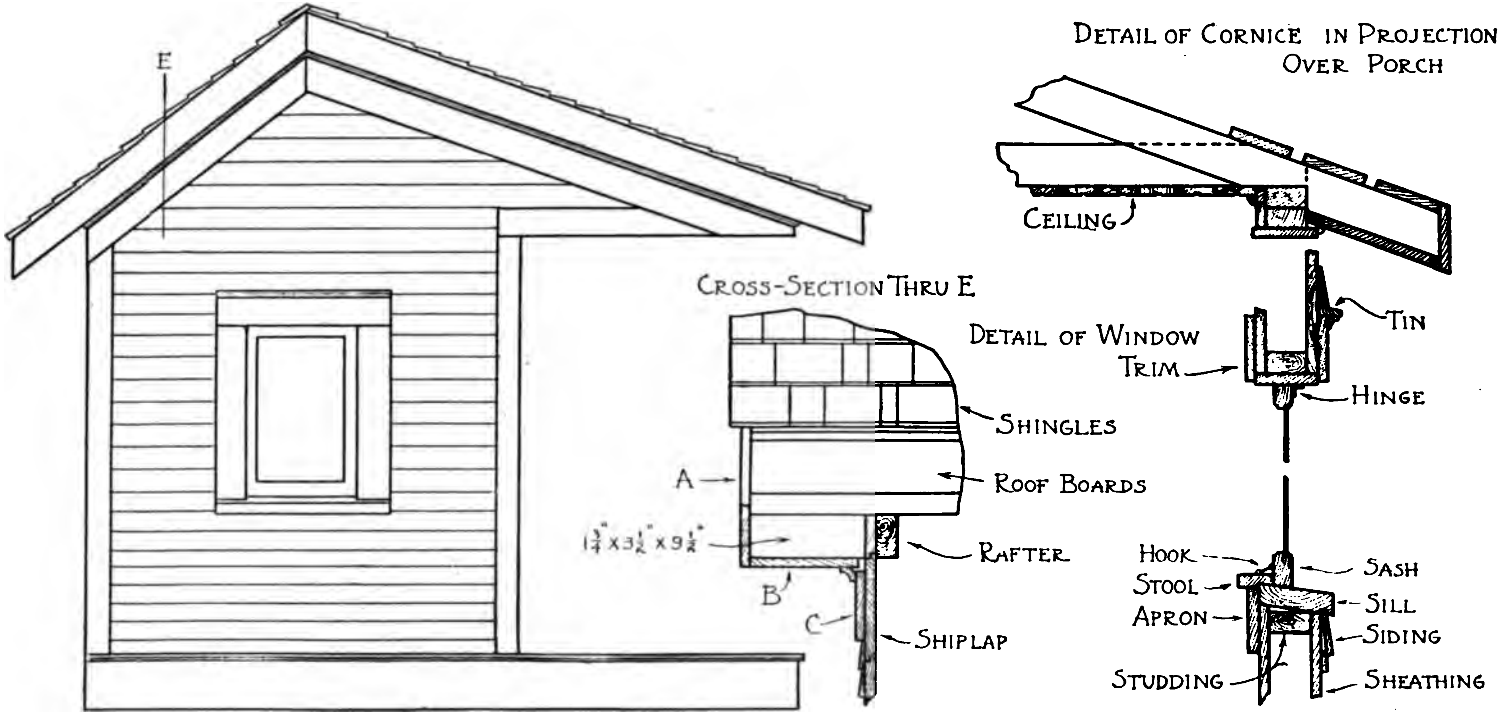
oof boards. Fit the first bout 1″ apart. The roof r 1x6's are generally used. ⁄2″ over the edges of the studding 9½″ long to nail port the under part of the refer to the detail "Cross otice that piece *A* is nailed above, then *B*, and lastly *C*. *B* and *C* are not put together so as to fit, but the space left is filled with a piece of molding. This process for the gable end of the building applies just the same for the rafters, the only difference being that a groove is cut in the lower cornice board to allow the siding to fit up under, as in the window sill.

Ceiling is used to cover the porch ceiling.

Corner boards are used, but the siding may be mitered at the corners if desired.

PLATE 40

CHILDREN'S PLAYHOUSE



CAMPING.

In this group are problems which have considerable value in that they afford extremely accurate practice in mortise-and-tenon joining. Any inaccuracy will cause the bed or folding chairs to fold poorly. The punt provides work in real carpentry, and it will appeal to every boy who has access to a stream, pond or lake. The joints need to be made with unusual accuracy to prevent trouble from leaking.

CAMP BED.

A well-made folding lounge or camp bed is a great favorite, not only on camping and outing trips, but in the home as well. It is more comfortable than a hammock, and it can be quickly carried to any desired shady spot, ready for immediate use. Nothing is cooler for the warm summer days, since the canvas admits air underneath the body. On cooler days, comforts may be laid over the canvas to give warmth. When not in use it may be folded into a small space, and can be made to hang on a wall if desired.

The camp bed given here is large enough for grown people. A shorter bed may be made, suitable for children.

Material. Stock, finished dimensions.

Six pieces 1½"x1½"x2'10" oak.
Two pieces 1½"x1½"x6'6" oak.
Three bolts ⅜"x4" with washers.
Eight pieces iron ⅛"x1"x8".
Three dozen 1¼" No. 9 flat-head screws.
One piece canvas 2'9"x6'6".
Six dozen upholstery tacks.

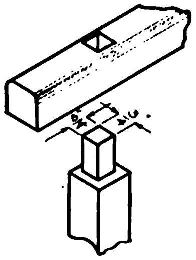
Tools. Saws, plane, brace, ⅜" and ¾" bits, hammer, screwdriver, small drill for screws, wrench, chisel, T-bevel and gage.

Working Directions. Put the two long pieces together so that in laying out the mortise-and-tenon joints they may both be marked out at the same time. Draw the first line in ⅞" from the end, the second ¾" farther, then ¾", ¾", 2'10¾", ¾", ¾", ¾", 2'10¾", ¾", ¾" and ⅞". Now mark the places for the mortises. There are to be three on each piece. In gaging for the mortises be sure that they alternate in the spaces marked, so that the legs will fold easily. Set the gage to ⅜" and mark each joint. Set the gage ¾" farther, or at 1⅛", and mark each joint again. Draw diagonals across each square and with a ¾" bit bore a hole in the center of each, then chisel out the corners to make the square. Round off the upper corners of the pieces with a plane, as shown in the detail of the joint. This is to give a round surface which will not wear out the canvas. Measure off on one end of each of the legs a tenon ¾" square and 1½" long. Make the tenons. Measuring down 16" from the end, mark and bore a ⅜" hole in each leg, for the bolts. To get the angle of the legs at the bottom, draw a line on the floor or bench 2'8" long and at the end of this erect a perpendicular 16½" long. Draw the hypotenuse of this angle and set the T-bevel to the angle at the bottom. Lay off each leg and saw off the corner, being careful to have the holes coincide and the slanting edges parallel. The tenons should now be placed in the mortises, and two brads nailed thru each piece. Now put on the eight angle irons as shown in the detail of the brace for the joint. Put in the bolts. There should be washers on each end of the bolt. The canvas may now be tacked on. Care must be taken to get the canvas tacked on straight so that when weight is applied the surface will not be uneven.

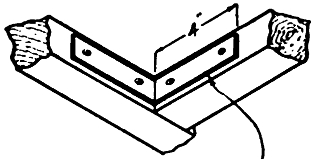
PLATE

CAMP BED

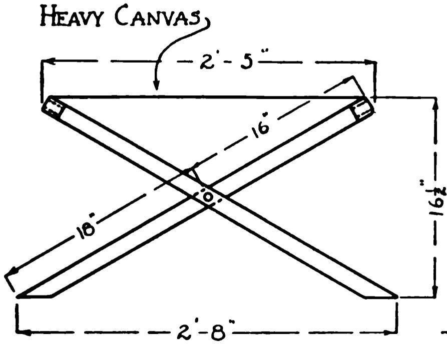
DETAIL OF JOINT

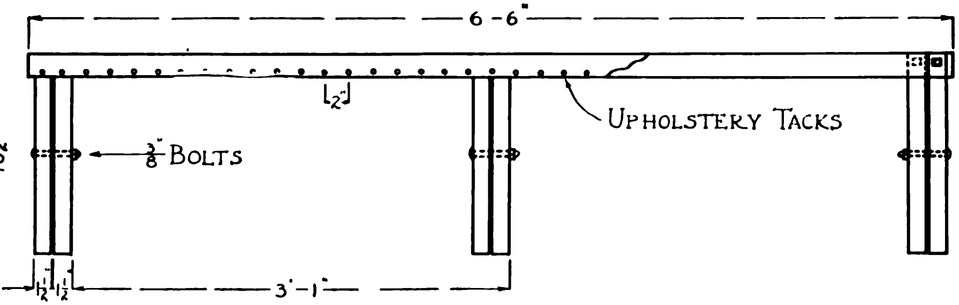


BRACE FOR JOINT



EIGHT PIECES IRON 1/8" X 1" X 8"





STOOL.

est conveniences one can
.ating trips, but for use in
particularly light and very

nsions.
legs.
upper crosspiece.
rossbrace.
rossbrace.

ead.
acks.
7".

and ¾" bits, gage, rule,
compass, try-square, T-

e four legs to dimensions
w diagonal lines across an
d with the compass set at
he end of each. Measure
asure down from the same
the piece. Set the T-bevel
angle of 3" to 3 13/16" (see
e leg at this angle and saw.
d tenon.
to dimensions and measure
piece, ⅞" from each end
holes. This round tenon
ints and drive a small brad
el rod into place and drive
t on the lower crossbraces
have a small chamfer on

Put on the canvas with upholstery tacks.

The stool is made in this manner that it may be folded and carried from place to place.

FOLDING CAMP CHAIR.

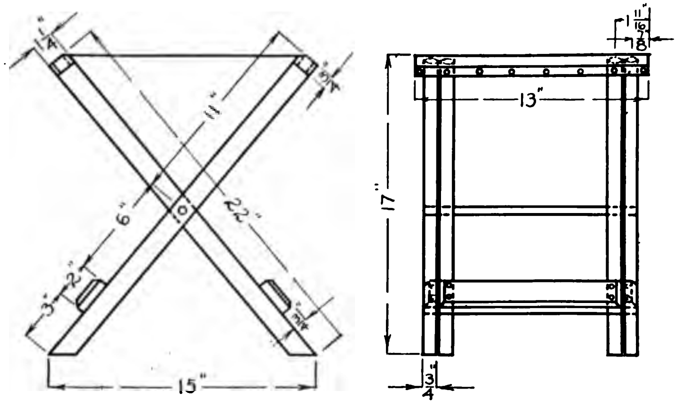
The folding camp chair is really a camp stool with a back. It serves the same purposes, and is a little more comfortable.

Material. Stock, finished dimensions.
Four pieces ¾"x1¼"x22" for legs.
One piece ¾"x1¼"x15½" for back crosspiece.
One piece ¾"x1¼"x12" for front crosspiece.
One piece ¾"x2"x12" for front brace.
One piece ¾"x2"x13½" for back brace.
Two pieces ¾"x1¼"x19¾" for back.
One piece ¾"x1¼"x15" for back.
One dowel ½"x13½".
Eight screws 1½" x No. 9 flat-head.
Fourteen upholstery or brass-tipped tacks.
One piece of stout canvas 12"x17".
Two bolts ⅜"x2".

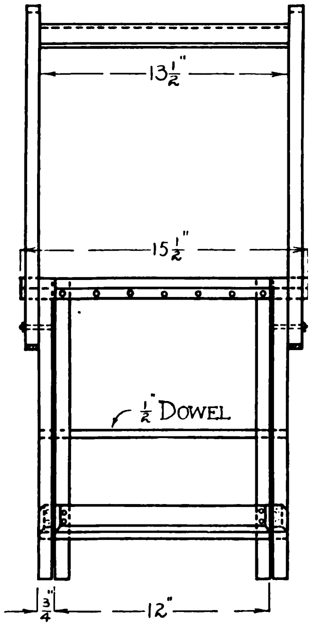
Tools. Saws, plane, brace, ½" and ¾" bits, gage, rule, chisel, screwdriver, countersink, compass, try-square, T-bevel and hammer.

Working Directions. This problem and its construction is identical with the preceding one with the exception that the upper crosspieces which hold the canvas have different lengths and the lower braces and the dowel rod are longer. This chair is made by extending the back crosspiece *A* so that the back part of the chair marked *B* in the drawing may lean against the projection. The bolts which hold the back are put down on the legs 3½" from the top. This back folds down over the chair.

FOLDING CAMP STOOL



FOLDING CAMP CHAI



CAMP CHAIRS.

The camp chairs given here are not adjustable, nor do they fold, as camp chairs often do. Their stability, however, more than offsets the convenience of a folding chair, which is never so satisfactory for rough usage. Being put together with screws, they may be easily taken down and reassembled when they are taken on a camping trip.

No. 1.

Material.

One piece ⅞"x10"x8'.
One piece 1¼"x1¼"x3'8".
One piece stout canvas 20"x6'.
Two dozen 1½" No. 9 flat-head screws.

Bill of Stock. Finished dimensions.

Two pieces ⅞"x2"x6'3".
Two pieces ⅞"x2"x2'9".
Two pieces ⅞"x2"x2'8".
Two pieces ⅞"x3½"x8".
Two pieces 1¼" round, 21¾" long.
Two pieces ⅞"x2"x2'4" for braces.

Tools. Saw, plane, gage, T-bevel, brace, 1" bit, small drill for setting screws, countersink, screwdriver, yard stick, chisel, and hammer.

Working Directions. To lay out the pieces called for in the bill of stock, lay off a line on the floor, or use a crack in the flooring 4' long. Draw a second line 2'5" above this line and parallel to it. Mark two points on the first line taken, 3'9" apart. Lay one of the long pieces of wood down on the floor, the outer corner on the point to your left hand. Use 2'8" of the yard stick as a radius. Place this on the other point of the line and revolve the yard stick until it cuts the second line. Bring the long piece of wood to this point. Lay the short piece of wood in the same position which the yard stick occupies. You now have the exact positions of these pieces of wood. Mark and saw. Also mark and saw the slant on the ends of these pieces which are to stand on the floor. This method of getting angles is common among carpenters. Lay the pieces of wood again in position and fasten with the braces at *A* and *B*. These braces are put on with screws.

Lay off and bore the holes for the rounds at the places shown in the drawing. To mark the angle for the cross-lap joint in the back braces, place one piece over the other in the correct position and mark lines for the joint. Saw and chisel out the wood in each piece half the thickness of the board.

Make the rounds with a lathe or with plane and wood file. Use hard wood.

Put the chair together temporarily; put the canvas in the correct position and pin. Remove the canvas and sew it on the machine. Slip the canvas back over the rounds; put the rounds in position and fasten with small brads. Screw on the back braces. The chair is put together with screws so it may be taken down and packed into a small space for shipping if desired.

Paint a color to harmonize with the surroundings. Moss green is a good color for camp or outdoor furniture.

No. 2.

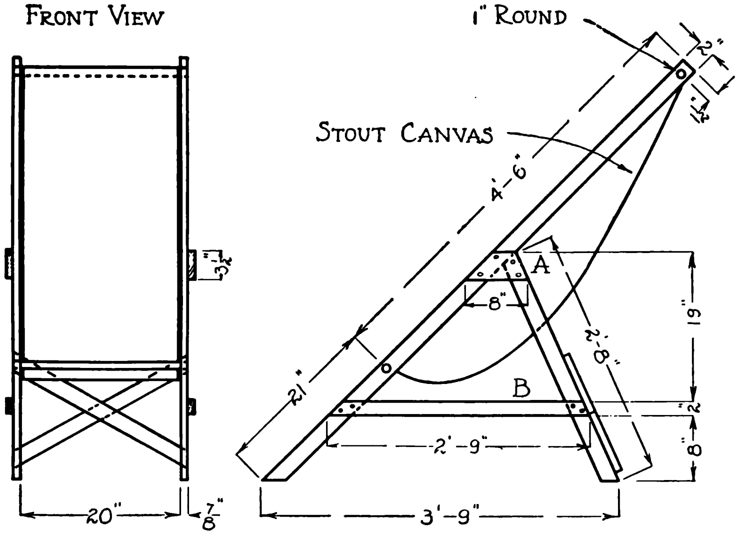
Bill of Stock. Finished dimensions.

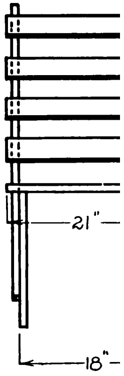
Two pieces ⅞"x16"x18" for legs.
Two pieces ⅞"x2"x3'3".
One piece ⅞"x3"x21".
Five pieces ⅞"x2"x21".
Four pieces ½"x2½"x21".
Ten 1½" No. 9 flat-head screws.
Some 6d and 8d casing nails.

Tools. Saws, plane, coping saw, screwdriver, brace, small drill, and hammer.

CAMP CHAIRS

No. 1





Working Directions. Lay out and mark the design you wish to use on the lower edge of the legs, then saw out with a turning saw. Rip out and nail on the seat boards, first rounding the top corners and freeing them from any roughness or splinters. Lay off and nail the pieces onto the back; then put the back in the desired position on the legs and fasten at the top with one screw. Now fasten at the bottom with one nail, then try out the seat to learn if the slant is to your liking. Put in enough screws to hold permanently. Paint to harmonize with outdoor surroundings.

CAMP CONVENIENCES.

The lock box is designed to be used for shipping groceries and supplies to be used on an outing trip. It is strong, being built to withstand knocks in shipping, and if carefully built, it is practically rain proof. The box also serves as an excellent container for supplies during an outing.

The mess kit serves as a container for foods, kettles, and all cooking equipment used on a camping trip. A wooden strip across the lid holds the covers and flat pans in place, while the leather strap above affords a place for keeping towels and dish-towels. The mess kit serves also as an excellent shipping box.

Lock Box.

Material. White pine or basswood.
One piece ¾"x10"x8'.
One piece ¾"x12"x7'.
One piece ½"x12"x3'4".
One piece ¾"x3½"x16½".
One pair 2" butt hinges with screws.
One hasp and padlock.
Some 8d common nails.
One pair handles.

Bill of Stock. Finished dimensions.
Two pieces ¾"x18"x24" for top and bottom.
Two pieces ¾"x12"x24" for sides.
Two pieces ¾"x12"x16½" for ends.
One piece ½"x12"x16½" for crosswise partition.
Two pieces ½"x12"x11" for lengthwise partitions.
Two pieces ¾"x1½"x16½" for braces for top cover.

Tools. Saws, hammer, planes, rule, framing square, try-square, gage, screwdriver, chisel, small drill for setting screws in hinges and hasps, etc., and clamps.

Working Directions. In order to make a neat box the 10" boards that are used for making the top and bottom should be glued together. This work should be done first, since time will be required for the glue to set.

Saw to dimensions the sides and ends and nail together at each end. Plane the bottom to fit, then nail it on. Take the actual measurement for the crosswise partition; lay it off; saw and nail the partition in the box. Likewise measure, saw and put in the other partitions, first cutting a ¾"x1½" notch out of each corner so as to allow the braces for the cover to fit down into the box. (In general, when making partitions from commercial sized lumber it is best to take actual measurements, since the thicknesses of materials vary considerably.) Finish the cover to fit the top, and screw on the braces, sometimes called battens. Lastly put on the hinges and hasps.

Mess Kit.

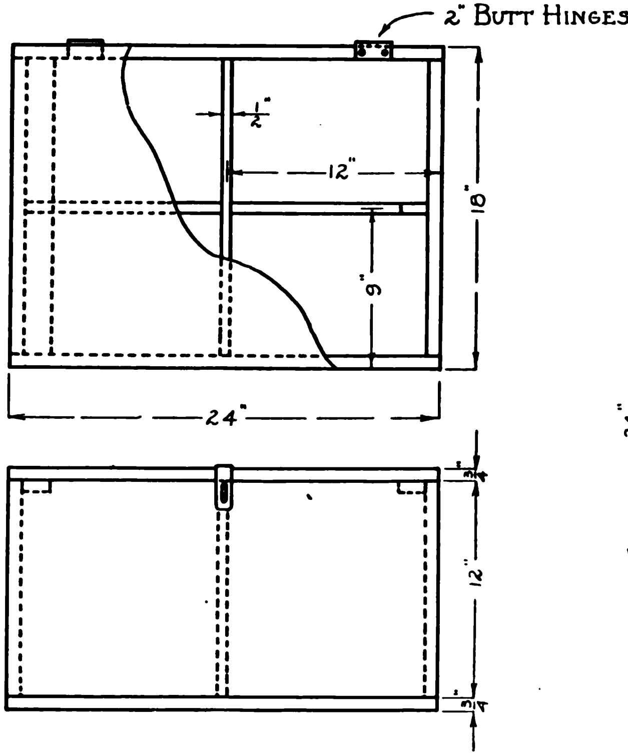
Material. Basswood or white pine.
One piece ¾"x10"x8'.
One piece ¾"x8"x12'.
One piece ½"x8"x4'
One pair 2" butt hinges with screws.
One hasp and lock.
Two 10" pieces of strap with buckles.
One pair handles.

The tools used in making the mess kit are the same as for the lock box. The construction of the mess kit is so nearly like the lock box just given that the working directions need not be given.

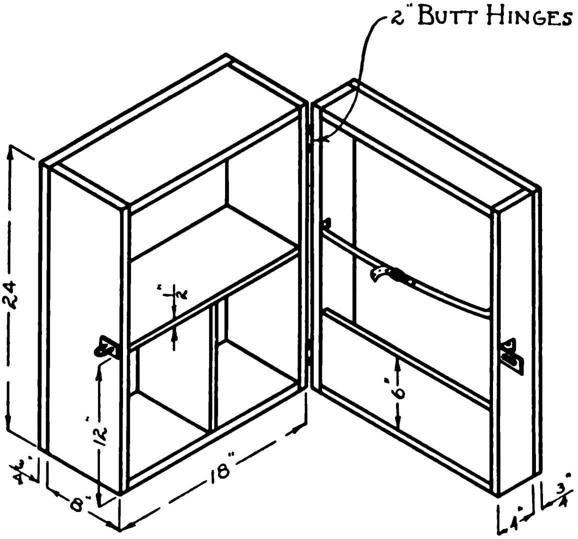
PLATE 44

CAMP CONVENIENCES

LOCK BOX



MESS KIT



PUNT.

Boys who live in the neighborhood of a pond, lake, or stream will find ample use for a well-built punt. It will afford a great deal of pleasure just in floating and rowing on the water, but its qualities are better put to the test where there are fish to be caught.

Material.

Three pieces ⅞″x12″x16′.
Three pieces ⅞″x12″x12′.
Twenty pieces ⅞″x4″x12′ flooring or 17 pieces ordinary 4″ lumber.
Four pieces ½″x6″ iron rod for oar lock pins.
White lead and lamp wicking.
Some long boat nails; use galvanized nails entirely.

Bill of Stock. Finished dimensions.

Two pieces ⅞″x6″x14′10¼″ for sides.
Two pieces ⅞″x12″x14′7″ for sides.
Two pieces ⅞″x5¼″x4′ for end and back.
Two pieces ⅞″x18″x3′10¼″ for seats.
Two pieces ⅞″x10″x3′10¼″ for seats.
Four pieces ⅞″x4″x18″ for side cleats.
Two pieces ⅞″x6″x18″ for oar pins.
Four pieces ⅞″x2″x10″ for cleats under seats.
Four pieces ⅞″x2″x18″ for cleats under seats.
One piece ⅞″x6″x11′10″ for keel strip.
Two pieces ⅞″x6″x1′10″ for keel strip.
Fifty-eight pieces ⅞″x4″x4′ matched flooring, or fifty-one pieces ordinary 4″ lumber.

Tools. Saws, planes, brace, 7/16″ bit, framing square, hammer, and combination plow plane.

Working Directions. The three 16′ boards will make the sides of the boat. Rip one board into two pieces, which leaves a 12″ and 6″ board for each side. In joining these side boards together you have your choice of two methods. You may make a tongue and groove joint as at *A* in the drawing, and fill with white lead to make waterproof. Or you may make a very small groove in the boards as at *B* and lay into the groove some kind of soft cotton cord such as lampwicking is made of. Work white lead into the groove and join the two boards together, fastening each side with three crosspieces, the end crosspieces being of 4″ boards and the middle ones of 6″ boards.

Saw these sides to 14′10¼″. Measure down 5″ from the upper corner, then in 18″ from the lower corners. Draw lines and saw, giving the slant to the ends. Turn the two sides upside down and nail on the ends. The floor boards are put on crosswise. If these boards are matched, as shown at *A* in the drawing, fill each joint well with white lead before nailing tight with long galvanized iron nails. Also, as you nail on the bottom boards, fill the edges at *C* well with white lead. When the lead oozes out of the joints as you work, scrape it off and use it in other cracks. Be sure your lumber for the bottom is very dry, otherwise the seams of the boat will open if it is brought onto dry land. Notice there is an inner keel strip 6″ wide running the entire length of the punt.

After the bottom and ends have been put on, the four seats may be put in. These rest on 2″ cleats that have been nailed directly over the side seam. They serve as seat rests, and they also strengthen the seams.

In the middle crosspiece bore two 7/16″ holes and drive in the rowlock pins. The centers of these holes are about 3″ apart.

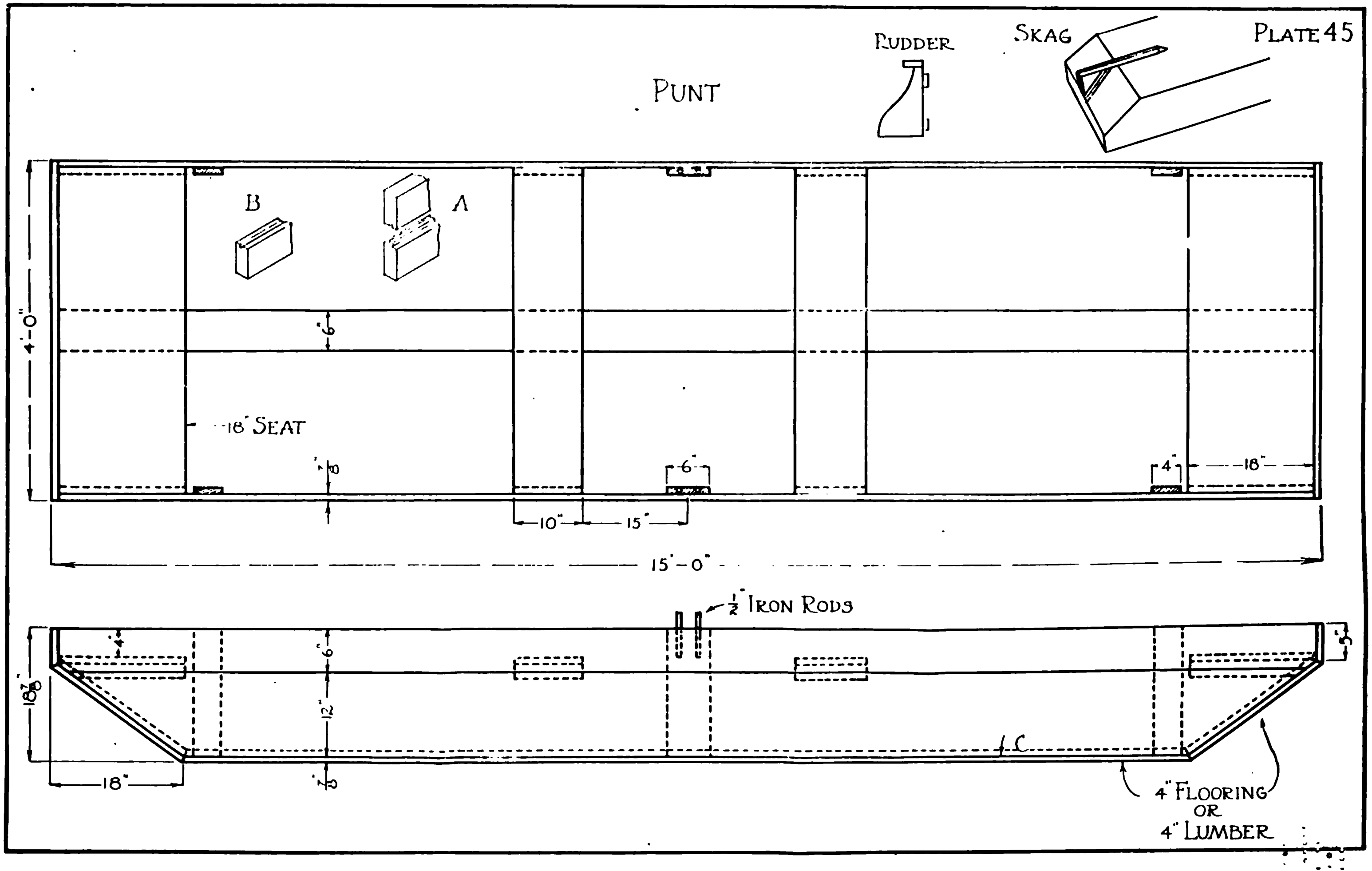
All of the work on the boat must be very accurately done. The boat must be strong to resist sharp rocks and snags which would loosen the wood and cause the boat to sink.

To make it steer well, a rudder or skag may be put on as shown in the drawing.

Paint the punt with at least two good coats of paint.

PLATE 45

PUNT



.OBLEMS FOR PETS.

or who are interested in
ıe opportunity of making
s of problems. Much of
the pigeon house and dog
ım coop and squirrel cage
outbuildings and poultry
ɔvides carpentry. It is an
nger boy particularly will

:EADING BOARD.

, can make wide use of an
:. Children are alert and
insects which they find in
These are usually brought
rds the best possible place
the different stages thru
. Much finer specimens of
the larvae are placed in the
as no chance to bruise or
ıe moth has hatched, if it is
e it in a tightly covered jar
minutes. Then mount on
ɛ drawing. Directions for
for making the spreading
interested in making moth
reading board their greatest

.ge.

ils, and 1½" brads.
ınd 4' long.

Bill of Stock. Finished dimensions.

One piece ¾"x12"x20".
Two pieces ¾"x2"x18½".
Two pieces ¾"x2"x10½".
Four pieces ¾"x¾"x12½".
Two pieces ¾"x¾"x20".
Five pieces ¾"x¾"x10½".
Two pieces ¾"x¾"x6".

Tools. Saws, plane, gage, rule, try-square, hammer and screwdriver.

Working Directions. Work all pieces to dimensions given in the bill of stock. Care and judgment must be used in putting this cage together as the wood is very likely to split when driving the nails and brads. At each end of one of the long side pieces marked *A* in the drawing nail a corner upright as *B* and *C*. To this, nail piece *D*. Make the opposite side in the same manner. At one end nail in *E, F* and *G;* then the two pieces at the opposite end. Nail on the bottom. Miter the pieces for the door. Ordinarily this is not a very good joint for a door, but in this case the screen serves to brace it.

In nailing on the screening tack one end across the lower end of the side, draw the wire up and across the top, then down the opposite side, draw-tacking all places carefully. Cut off the extra screen. Cut the last foot of screen into two parts for the ends. After the door has been finished, put on the hinges and hook.

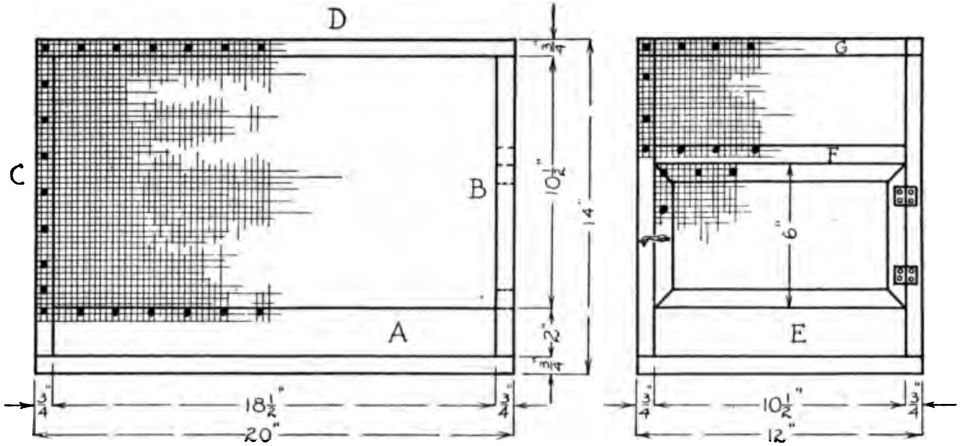
For the benefit of some larvae that pupate in the soil, fill the lower box almost full of loose soil.

SPREADING BOARD.

Bill of Stock and Material.

One piece ½"x5"x15".
Two pieces ¼"x2⅜"x15" very soft wood.
Two pieces ¾"x1⅛"x5".
One piece ¼"x1"x13½" cork.
Two 1" No. 9 round-head blue screws.
Some small brads and glue.

INSECT CAGE



Tools. Saw, plane, chisel, brace, a drill about the size of the shank of a No. 9 screw, screwdriver, knife and hammer.

Working Directions. Saw and plane all pieces to dimensions given in the bill of stock. The two end pieces and one wing board are the only ones requiring additional work. With a chisel narrow the two end boards from 1⅛" at the ends to 1" at the middle. Assemble all pieces except the one wing board which is to be made adjustable. Glue in the cork strip. To make the two slots in the adjustable wing board, bore several small drill holes close together and smooth out with a knife. Lay the board in position and put in the screws as shown in the drawing marked "adjustable." The spreading board may then be used for the smallest butterfly or the largest moth by loosening the screw and sliding the board over. Or it may be left wide at one end and small at the other, thus caring for the different sizes of insects at the same time.

In spreading the moths, long, thin insect pins are pierced thru the thorax of the newly killed moth, and stuck into the cork strip, leaving the body lengthwise in the opening, and the wings spreading out over the boards. Lay narrow strips of paper over the wings and fasten down with pins, being careful that the pins do not stick thru the wings to mar their beauty.

PLANT PRESSES.

The boy or girl who is interested in plant and flower collections will make good use of a well-made plant press. The first press is small and light, and easily carried, making it particularly good for use on a trip. Layers of thick blotting paper are placed between the halves of the press, the spaces of the press affording good ventilation so that the specimens will not mold.

The second press is larger and heavier, and suited for the laboratory, home, or schoolroom.

No. 1. For Field or Trip.

Material.

One piece ½"x10"x3'.
One piece ¾"x12"x16".
Two leather straps about 40" long with buckles.
Some thick blotting paper about 11"x15".
Some 1" and 1½" brads.

Bill of Stock. Finished dimensions.

(1) Twenty-two pieces ½"x1"x12" for crosspieces.
(2) Four pieces ¾"x1"x16" for outer braces.
(3) Four pieces ¾"x1⅜"x16" for inner braces.

Tools. Saws, plane, gage, try-square, rule and hammer.

Working Directions. Saw and plane all pieces to dimensions given in the bill of stock. No pieces will need any added work except the four center braces, marked No. 3 in the bill of stock, the ends of which are beveled ⅝" and the upper edges chamfered ¼".

In assembling each half, lay the ends and side pieces in place, and nail with one nail in each corner. Square this up carefully with the try-square before nailing permanently. Lay off and mark the positions for the crosspieces, they being ½" apart, and nail them on before nailing on the inner braces. Lastly lay off and nail on the inner braces.

With small common nails, nail the leather straps on one part of the press in such position that the buckle will be in about the position shown in the drawing.

No. 2. For Laboratory.

Material.

One piece ⅞"x12"x3'6".
One piece 1¾"x3½"x3'4".
Four bolts ⅜"x8" with lever nuts.
Some 8d common nails.

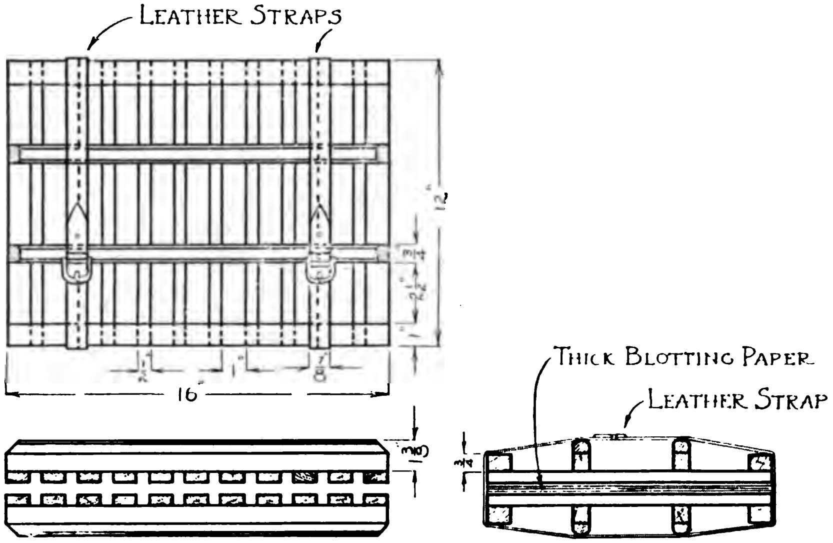
Bill of Stock. Finished dimensions.

Two pieces ⅞"x12"x20".
Four pieces 1½"x1½"x12".
Two pieces 1½"x1½"x15".

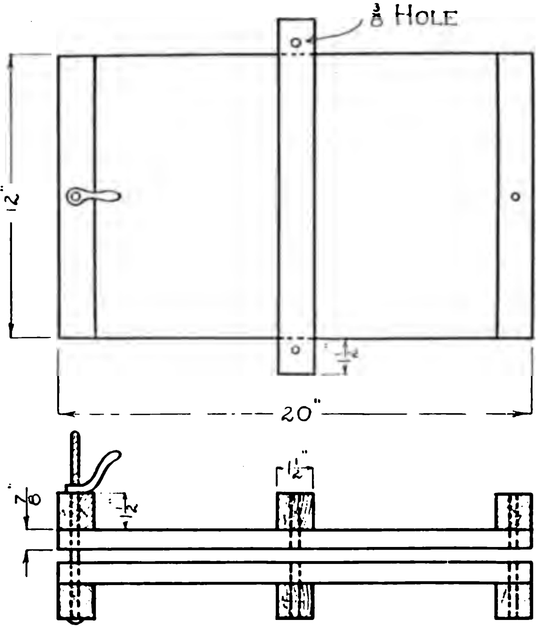
PLATE

PLANT PRESSES

FOR FIELD OR TRIP



FOR LABORATORY



Tools. Saws, plane, brace, ⅜" bit, try-square, gage and hammer.

Working Directions. Rip the piece of studding in the middle, and square up both pieces to 1½"x1½". Saw four pieces 12" long and two 15" long. Cut the board into two pieces 12"x20". Nail the four 12" braces to each end of the boards, being sure not to put nails in the middle of these pieces. The 15" brace is put on in the middle, the ends projecting 1½" on each side. Measure in 1" from the ends of this brace and bore ⅜" holes. Also at the ends of the press, bore ⅜" holes in the position shown in the top view of the drawing.

Slide in the bolts from the bottom of one of the parts of the press, lay in the blotters and papers, put on upper half of press, put on lever nuts and tighten.

If only a few plants are to be pressed at one time the end bolts are all that are needed. In this case the upper half of the press need not be taken entirely off, but just loosened enough to take out and put in the blotters and plants.

BOX TRAP.

Material.

One piece ¾"x10"x2'2".
One piece ½"x10"x6'6".
One pair small hinges.
One screw eye.
Some stout cord and 6d and 8d common nails.

Tools. Saws, plane, brace, ¾" bit, chisel, hammer, knife, screwdriver, and rule.

Working Directions. The back piece on the box proper is the only one that requires any extra work except squaring up to the dimensions. Draw a line thru the middle of this board. Up 4¾" from one end mark a point on this line, and bore a ¾" hole. Up 8½" from the same end mark a line across the center line, ¾" long. Make a cut with a chisel on this line and taper the notch downward so that piece *A* may catch into it. To shape the top of the back board, measure up 9" from the bottom on each edge. At the top measure 1" on each side of the center line and mark. Draw the slanting lines connecting these points, and saw and plane to the line. Saw out a V-shaped notch as shown at *B*.

Nail the bottom, sides and short top pieces together to form the box. Nail on the tall back piece. Make the lid by nailing the two pieces together, then put on the hinges. Put a screw eye in the lid, in the position shown in the drawing. Make piece *C*. This is practically the same piece as the long trigger in the "Figure 4" trap, only this one is shorter. Two notches are cut, one for the end of piece *A* and the other to catch on the inside of the hole thru which the trigger passes in the back of the trap. When the trap is set the weight of the lid keeps the sticks in place but the least move or shake of the "bait" loosens stick *A* which results in the trap "snapping," and the lid goes down with a bang.

"FIGURE 4" SQUIRREL TRAP.

Material.

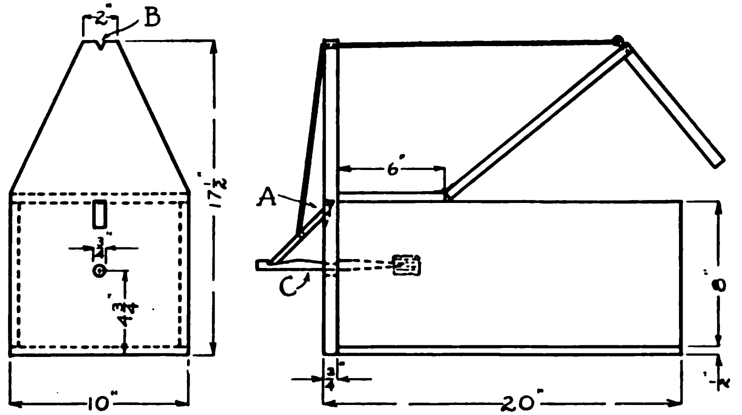
Any box about 10"x14"x20".
One piece ⅜"x¾"x18".
One piece ⅜"x¾"x5¾".
One piece ⅜"x¾"x6¼".

Tools. Plane, saw, rule, and pocket knife, altho a pocket knife is sufficient, and may serve as the only tool.

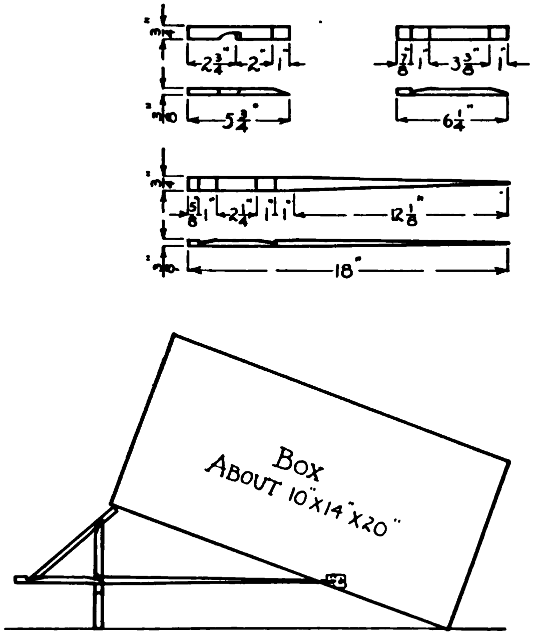
Working Directions. A close study of the drawing and of the dimensions in the detail will give enough directions for the ordinary boy. The only places that require special care are the two notches on the horizontal piece and the peculiar notch on the vertical piece. Cut the two notches so that the pieces will catch easily and yet not make it hard to "spring" the trap. Bait the trap with corn for squirrels and with apple or cabbage for rabbits. The "figure 4" is held in place by the weight of the box. If the box is of light material, weight it on

PLAT

BOX TRAP



"FIGURE 4" SQUIRREL TRAP



top with a brick. This makes the box drop quickly and also holds the animal inside after he is caught.

This trap may also be used for catching rabbits and birds of various kinds. For rabbits and squirrels it is set as shown in the drawing. For birds a string is attached to the lower long piece, the boy keeping out of sight and waiting until the bird has been lured under the box by food, when the string is jerked and the bird caught under the trap.

SWALLOW BOARD.

Swallows are interesting birds to study, their manner of building their nests being especially peculiar. Instead of choosing a snug place in a tree as birds usually prefer, they choose a smooth perpendicular wall space, often with no other support whatever. As the nest is built, a secretion from the mouth of the swallow glues it tight to the wall. The cleats on the board given here form a slight support for the nest, and the roof keeps the birds dry and warm.

Material. Yellow pine.

Two pieces 3½"x3½"x14'.
One piece 1¾"x10"x18'.
One piece 1¾"x3½"x8'.
One piece ⅞"x6"x12' cleats for nests.
One piece ⅞"x8"x16'.
Three pieces ⅞"x12"x16'.
One piece ¼"x12"x8'.
An assortment of nails.

Bill of Stock. Finished dimensions.

(1) Two pieces 3½"x3½"x14' for posts.
(2) Three pieces 1¾"x10"x5'8¼" for swallow board.
(3) Three pieces ⅞"x2"x5'8¼" rests for nests.
(4) Three pieces ⅞"x2"x5'1¼" rests for nests.
(5) Four pieces 1¾"x3½"x2'¼".
(6) Two pieces 1¾"x3½"x5'4¾".
(7) Four pieces ⅞"x3½"x3'7" for casing.
(8) Two pieces ⅞"x3½"x3'6½" for casing.
(9) Two pieces ⅞"x5½"x24" for casing.
(10) Twelve pieces ⅞"x12"x3'10" for roof boards.
(11) Ten pieces ¼"x2"x3'10" strips for roof.

Tools. Saws, planes, gage, framing-square, try-square, T-bevel, rule, and hammer.

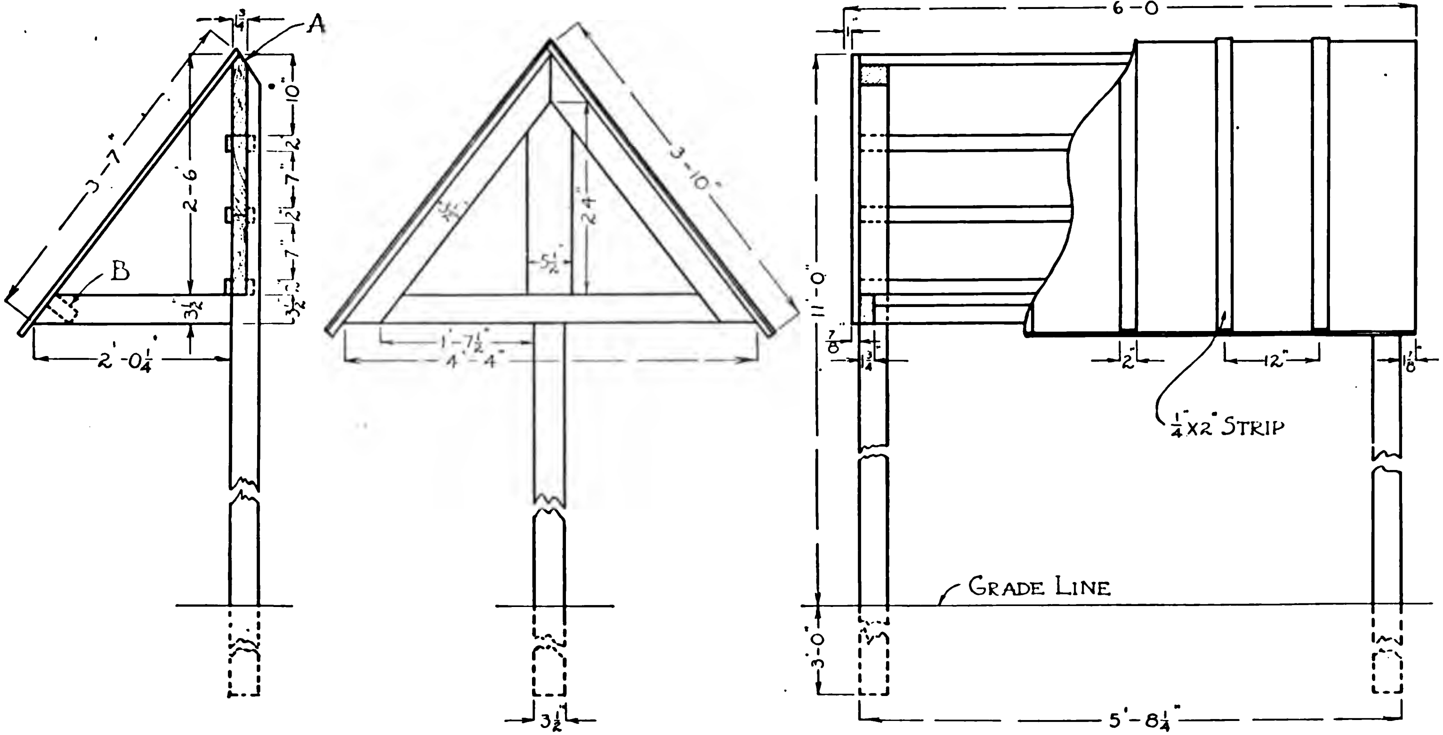
Working Directions. This is a rather large and heavy structure, hence only the frame will be put together while on the ground. The remainder will be put on after the posts have been set into the ground. It may, however, be completed before being set into place if enough boys are near to help raise it.

On the posts measure down 2'6" and square around. With a pencil gage draw a line in the middle of two opposite sides of the length previously measured and rip to this line. With a crosscut saw cut off one-half from the piece. Saw the 2x10 into three pieces 5'8¼" long. Spike on two of these pieces to the posts, the 2x10's coming flush with the outside of the posts. Before nailing on the last and upper piece, it should be chamfered on both sides until the middle is a sharp edge as shown at *A* in the drawing. To get this angle set the T-bevel on the square, using 5½" on one arm and 7½" on the other. Put the 2x10 on temporarily, just long enough to make a point where the lower point of the bevel touches the post. Set the T-bevel on this point, mark and saw off the post at the angle. Spike on the 2x10. These 2x10's form a smooth perpendicular wall where the swallows may glue their nests. Rip out and nail on the cleats for the nests to rest on, Nos. 3 and 4 in the bill of stock.

Cut four pieces of 2x4 to 2'¼", and with the angle on the T-bevel mark and saw off the upper corners to make them correspond to the shape of the roof. These pieces are butted up against the outer edges of the posts just below the nesting board. Two pieces, *B*, are cut and nailed between these pieces of studding just nailed on, the edge conforming to the slant. This affords a nailing place for the roof boards.

PLATE

SWALLOW BOARD



It would be better to raise the frame and "set" the posts into the ground, before continuing with the work. A step-ladder or light short ladder will be needed in completing the structure. The casing of the front and back should now be done. To get the angles either use the T-bevel as it has been set, or use the framing square with the same numbers. The casings under the roof are put on first, then the lower one and lastly the middle one. Cut and fit the top end of the middle casing first, and then actually measure the length on the piece in order to get the exact length. The roof boards are then nailed on, starting the first board 1″ over the outside casing. Nail strips over the joints in the boards, as shown in the drawing.

RABBIT HUTCH.

The rabbit hutch given here is arranged for a small back yard. The dimensions of the runway and also the hutch proper may be easily changed to accommodate as many rabbits as desired.

Material.

Seven pieces of shiplap ⅞″x8″x12′.
Two pieces ⅞″x12″x14′.
One piece ⅞″x10″x12′.
One piece ⅞″x6″x10′.
One piece ¼″x12″x3′6.
Two pairs small butt hinges.
Four pieces of leather for hinges.
Six yards of 1″ poultry netting 36″ wide.

Bill of Stock. Finished dimensions.

For Hutch.

Two pieces ⅞″x2″x3′ for *A*.
Four pieces ⅞″x2″x2′4″ for *B*.
Two pieces ⅞″x2″x2′1″ for *C*.
Four pieces ⅞″x2″x16″ for doors.
Eight pieces shiplap ⅞″x8″x3′ for ends.
Eight pieces shiplap ⅞″x8″x5′10¼″ for front and back.
Four pieces shiplap ⅞″x8″x2′10¼″ for partition.
Six pieces ⅞″x12″x3′5½″ for roof.
One piece ⅞″x4″x3′5½″ for roof.
Six pieces ¼″x2″x3′5½″ strips for roof.

For Runway.

Two pieces ⅞″x2½″x5′10½″ for *D*.
Three pieces ⅞″x2½″x24″ for *E*.
Three pieces ⅞″x2½″x3′ for *F*.
Three pieces ⅞″x2½″x3′2″ for *G*.
Four pieces ⅞″x2½″x3′2″ for *H*.
Four pieces ⅞″x2½″x2′7½″ for *I*.
One piece ⅞″x3½″x3′2″ for *J*.

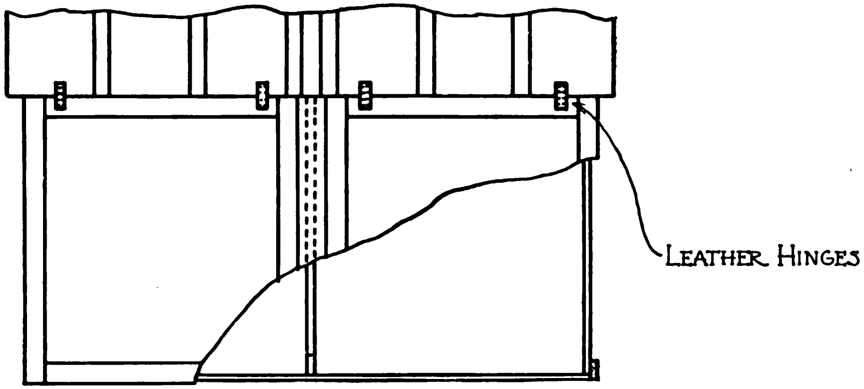
Tools. Saws, plane, gage, rule, try-square, framing-square, brace, ⅜″ bit, and hammer.

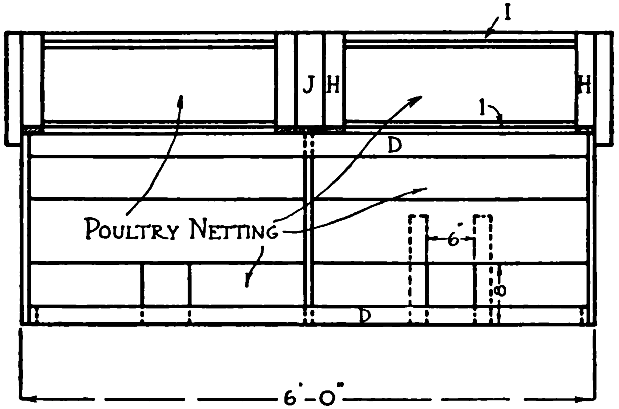
Working Directions. Construct both ends of the hutch part first. Rip out pieces No. 1, 2, 3, and 4, in bill of stock. The bottom piece of shiplap is 3′ long. The next two pieces are also 3′ long but they are sawed into three pieces, allowing 14″ for the door. Lay down and nail on pieces *A*, *B*, and *C* in the proper places, *A* and *C* each being set in ⅞″ from the end and pieces *B* at each side of the door opening. Cut the next piece of shiplap at an angle on the framing square, at the ratio of 1 to 3, as 8″ on the tongue and 24″ on the blade. The piece that is left after sawing will make the small upper piece. Cut and nail on the front and back pieces of shiplap, leaving two openings 6″x8″ in the middle of each section in front. Saw and nail in the partition. Nail on the roof boards and strips.

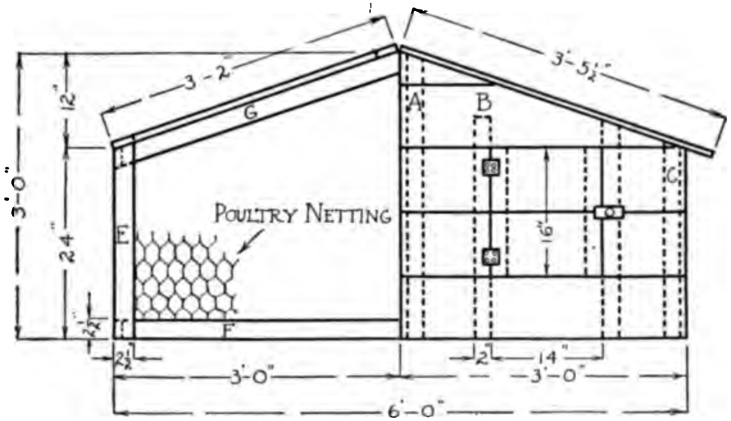
The runway is an addition to the hutch proper, and is really made separately and then fastened to the hutch. This runway is merely a frame covered with poultry netting, which has two doors hinged to the roof of the hutch with leather hinges. The pieces marked *F* are toenailed to the hutch. The lower piece *D* is put in; then the upright pieces *E* are nailed to the frame at the bottom. The upper piece *D* is then nailed on; then *G* and *J*. Pieces marked *H* and *I* form the doors. These are put to-

PLATE

RABBIT HUTCH







gether with mortise-and-tenon joints. Tack the wire netting onto the partition first, since it will be easier to get at it. Tack the netting on the inside of the remainder of the runway. This will prevent the rabbits from gnawing the frame.

SQUIRREL CAGE.

The boy who loves animals will find an interest in this squirrel cage. It is easily made and it is a very attractive appearing cage. The revolving cylinder affords exercise and amusement for the animal. A box placed inside the cage will afford a warm dry place for bad weather. The door is built large enough to admit a boy, who will wish to clean the cage occasionally.

Material.

One piece 1¼"x1¼"x12'.
One piece 1¼"x1¼"x10'.
One piece ⅞"x10"x16'.
One piece ⅞"x10"x8'.
One piece ⅞"x12"x24".
Fifteen pieces flooring 4"x14'.
One dowel ½"x2'6".
One pair 1½" hinges with screws.
One hasp and lock.
An assortment of nails.
Seventeen feet of wire netting 5' wide.
Eight feet of wire netting 3' wide.
Three feet two inches of galvanized wire ⅜" mesh, 18" wide for cylinder.
Some small staples.

Bill of Stock. Finished dimensions.

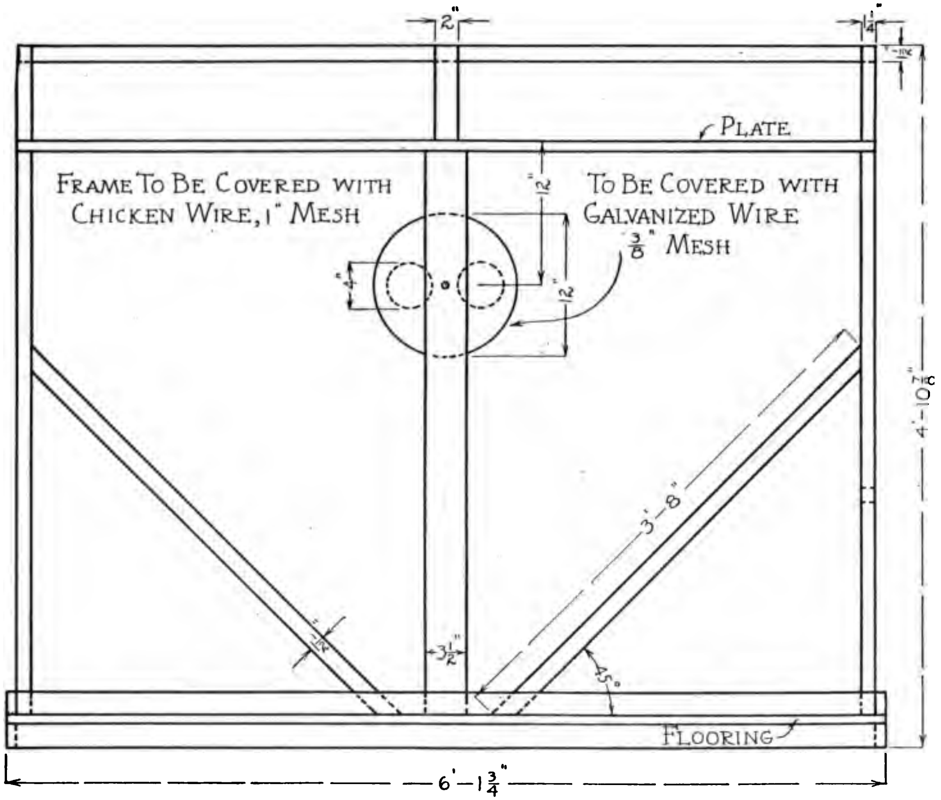
(1) Four pieces ⅞"x2"x6'1¾" for platform.
(2) Four pieces ⅞"x2"x2'6" for platform.
(3) Ten pieces 4" flooring 6'1¾" for floor.
(4) Two pieces ⅞"x3½"x3'11⅛" for middle posts.
(5) Four pieces 1¼"x1¼"x3'11⅛" for corner posts.
(6) Four pieces ⅞"x1½"x3'8" for braces.
(7) Four pieces ⅞"x1¼"x16½" for end rafters.
(8) Two pieces ⅞"x2"x16½" for middle rafters.
(9) One piece ⅞"x1½"x6' for ridge board.
(10) Two pieces ⅞"x1¼"x6' for plates.
(11) Two pieces ⅞"x1¼"x2'3½" for end plates.
(12) One piece 1¼"x1¼"x2'3½" for crosspiece above door.
(13) Two pieces 1¼"x1¼"x18" for frame for door.
(14) Two pieces ⅞"x1½"x16" for door.
(15) Two pieces ⅞"x1½"x15" for door.
(16) Two pieces ⅞"x12"x12" for ends of wire cylinder.
(17) One piece ½" dowel 2'6" long.

Tools. Saws, plane, gage, T-bevel, dividers, framing-square, try-square, rule, hammer, screwdriver, keyhole saw, brace, ½" bit, tinner's snips.

Working Directions. Lay out and saw all pieces to dimensions given in the bill of stock. A careful study of the drawing is about all that a boy will need in order to construct the cage. With Nos. 1, 2, and 3 in the bill of stock build the platform floor and the enclosure around the floor. Nail on the corner and middle posts. Nail onto the top of these the side plates, then toenail the end plates to these. Miter the ends of the braces, No. 6 in bill of stock, to an angle of 45°, and nail these on. The rafters are 16½" long. Set the T-bevel on the framing square at an angle of 8" to 14½". See illustration on Plate 2. This setting will make both angles by reversing T-bevel. Nail the rafters to the ridge board, then nail all the rafters to the plate.

Put in the crosspiece for the door, then the upright pieces on each side of the door. Make the door, the tenons being ⅜" thick, 1" wide and 1" long. Hinge the door in place without putting on the wire mesh. To make the end of a cylinder saw the 12" piece of board into two pieces. Draw diagonals to find the center. Set the divider to a 6" radius and make a 12" circle. Saw to the line with a turning saw. Bore a ½" hole thru the center. Make the other piece in the same way. Then draw the diameter to find the position for the two 4" circular openings.

SQUIRREL CAGE


2"
1/4"
1 1/2"
PLATE
FRAME TO BE COVERED WITH CHICKEN WIRE, 1" MESH
TO BE COVERED WITH GALVANIZED WIRE 3/8" MESH
12"
12"
4"
3'-8"
1 1/2"
3 1/2"
45°
FLOORING
6'-1 3/4"
4'-10 7/8"

Bore a hole for the keyhole saw and saw out the two circles. Tack the ⅜" wire mesh onto the two circular pieces and your wire cylinder is completed. Measure down 12" from the top of the plate on each middle post and bore a ½" hole. Slide the ½" dowel thru the cylinder. Drive a brad in at each end to keep the dowel in place. Place the cylinder in the middle of the dowel, and drive two 8d nails thru the dowel on each side of the cylinder to keep it in place while revolving. File off the heads of the nails.

Tack on the 5' netting around the entire cage and over the door. Nail it in place. Then with the snips cut out the piece for the door. This will make a smoother and neater job. Cut off any ends that project. Put the 3' netting on the long way of the roof. Enough wire is left to cover the triangular ends. After the netting has been put on a few sticks or rods may be run thru to give the squirrels something to climb on.

BANTAM COOP.

The boy who has a little flock of bantams needs such a house as this to keep them in. Several pet chickens may also be housed here. The coop has a window on each side, a door on one side, and the back part has been left open, with poultry netting nailed on the inside. For cold weather two canvas covered frames are made to slip into the outside in the same manner as a window screen is put in. This is shown in detail.

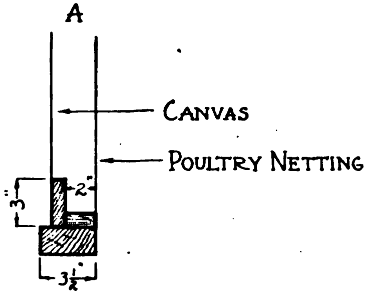
This drawing is only a suggestion and it may be altered in many ways. Many times it is convenient to build the house against some other building or in a corner, thus saving much lumber. The roof also may be made from old rubberoid roofing that has been taken from some building, there being always much of the roofing that has considerable wear left in it.

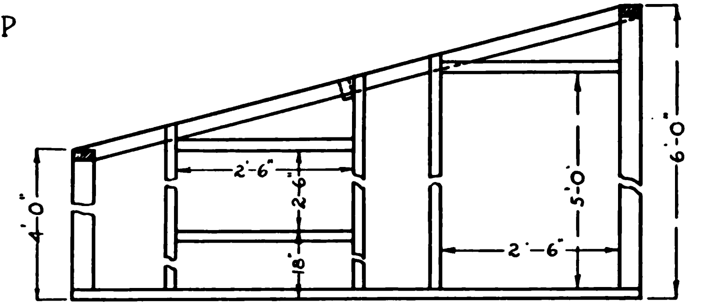
Set the building with the back to the north and the highest part to the south, to admit an abundance of light. The front elevation is not shown in the drawing. The window space and spacing are left to the builder. Be sure that plenty of glass space is provided for, and place the windows high to admit the most sun. All ventilation is provided in the best possible way by the canvas back.

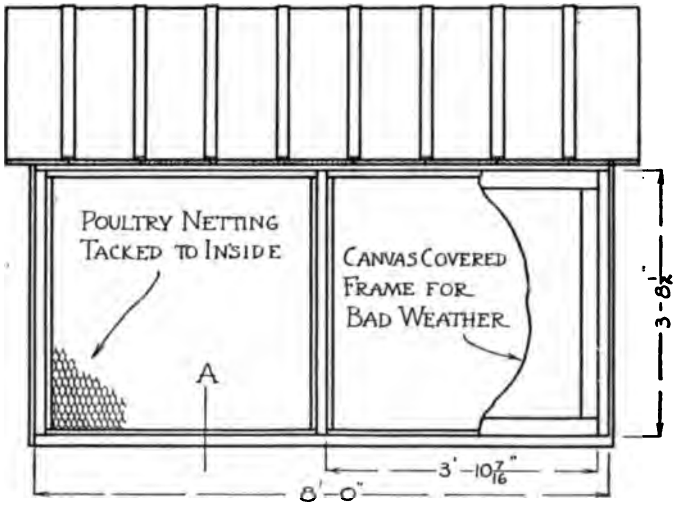
Material. For the building as is shown in the drawing.
Seven pieces 2"x4"x8'.
Five pieces 2"x4"x12'.
Three pieces 2"x4"x10'.
Five pieces ⅞"x12"x18'.
Eleven pieces ⅞"x12"x12'.
Two pieces ⅞"x6"x12'.
Four pieces ¼"x2"x18'.
Ten pieces ¼"x2"x12'.
One piece of poultry netting 4'x8'.
Two pieces canvas 3'6"x3'8".
One pair of strap hinges.
An assortment of nails.
Two window sashes.

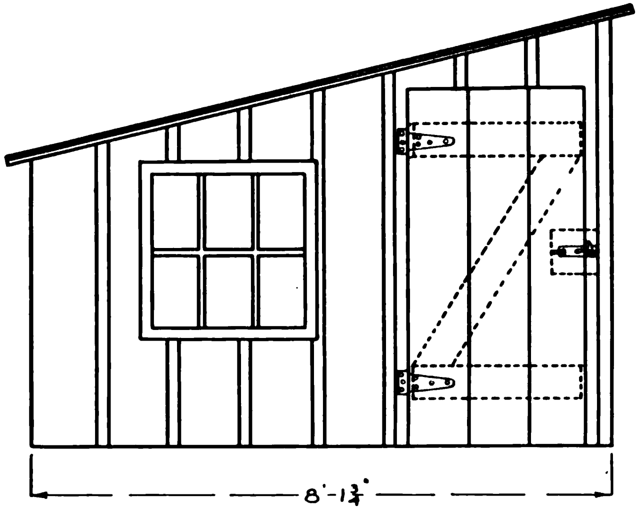
PLATE 5

BANTAM COOP






POULTRY NETTING TACKED TO INSIDE
A
CANVAS COVERED FRAME FOR BAD WEATHER
3'-8½"
3'-10 7/16"
8'-0"



PIGEON HOUSE.

Pigeons are raised both for pleasure and profit. This house has been designed to fit both conditions. It is large enough to stand in, it has a floor, and the door can be locked so that only the birds can get to the inside thru the openings made for them above the door. Provision has been made for light, nesting boxes and perches. The nesting boxes, shown in detail, are to be nailed to the wall close to the eaves. The front board on the nesting boxes is put on with hinges and fastened up with a hook so that the nest can be easily cleaned. The perches are toenailed to the wall below the nests.

Material.

Eleven pieces 2"x4"x8'.
Eight pieces 2"x4"x14'.
Fourteen pieces ⅞"x12"x16'.
Nine pieces ⅞"x12"x14'.
Ten pieces ¼"x2"x14'.
Four pieces ¼"x2"x16'.
Two window sashes.
One pair of strap hinges for door.
One hasp.
Several pairs small butt hinges for nests.
An assortment of nails.

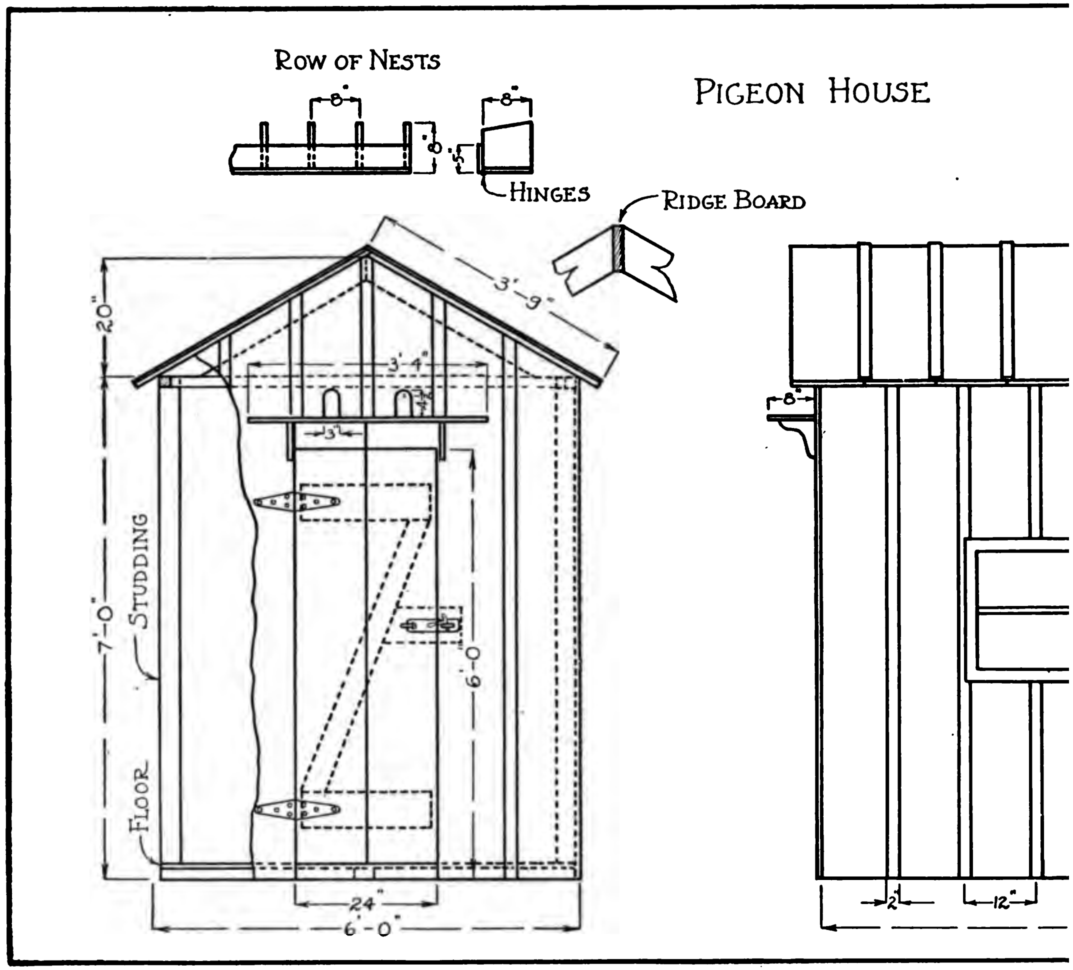
Tools. Saws, plane, framing-square, rule, try-square, screwdriver, brace, small drill, keyhole saw, and hammer.

Working Directions. This work will proceed much as in house construction. Lay down two 8' pieces of studding for the sides and two 5'10¼" pieces of studding for the ends, Cut and nail in the middle lengthwise piece of studding. Nail on the floor. This will require eight pieces 12" wide and 5'10¼" long. Erect the corner uprights. These are placed on the floor which you have built. Nail the plate onto the top of these uprights. A piece of studding should be nailed on each side of the window and above and below to make the opening. The door has a studding at each side and one directly above. The studdings at each end are notched at the top to allow the end rafters to fit flush with the corners. The rafters are then sawed as shown in the drawing, allowing for the ridge board. Four sets of rafters will be required, one set at each end and two others spaced 2' apart. Nail all rafters and studding into their proper places, and then begin nailing on the siding. Saw the door pieces to proper lengths, and nail the pieces above, leaving the door to be put on later. Bore and saw out the openings for the birds, and put on the brackets and platform in front. The roof should then be put on, each piece being beveled to the slant of the roof. All joints are stripped both on the roof and sides.

The two boards for the door are held together and braced by two crosspieces and a diagonal as shown by the dotted lines in the drawing. The door is hung with two strap hinges and held shut with a hasp which may have an ordinary catch or a Yale lock.

The nests for the pigeons may be constructed in rows to save time and material. The row shown in the detail will prove satisfactory. The front board is hinged so that it may be turned down in order to clean out the nests easily. Perches may be constructed as shown in the detail.

PIGEON HOUSE



DOG KENNEL

The boy who loves his dog as a companion, or who keeps a dog for his protection, will be interested in building the animal a comfortable home, where he can sleep warm on cold nights, and where he can intrench himself if trouble comes in the form of other canines belligerently inclined.

Material. Yellow [illegible].
One piece [illegible] 4'.
Three pieces [illegible] 10' shiplap.
One piece [illegible] 6' shiplap.
Two pieces [illegible] 10".
One piece [illegible].
Some 8d common nails, and shingle nails.

Bill of Stock. Finished dimensions
Two pieces [illegible].
Two pieces [illegible].
One piece [illegible].
Two pieces [illegible] for crosspieces.
Six pieces [illegible] shiplap for sides
Five pieces [illegible] shiplap for floor
Four pieces [illegible] shiplap for ends
Two pieces [illegible] shiplap for ends
Eleven pieces [illegible] for roof
Ten pieces [illegible] strips for roof

Tools. Saws, plane, try square, framing square, gage, brace, extension bit, turning saw, hammer and compass.

Working Directions. Saw to the proper length the pieces of studding to be used under the floor. Make an end lap joint at each corner, first measuring and gaging, then sawing and chiseling out the wood. Nail the joints together. Saw the flooring to 31" and nail to the platform crosswise as shown in the drawing. Now make the two ends. Notice that the roof pitches at an angle of 45°. Follow these directions carefully in making the four pieces which are used on the sides of the ends, and you will learn how to cut the 45° angle which gives the roof slant, with the least possible work and the least possible waste. Square an end of a board, measure up 23" and mark a point on the edge. Place an outer edge of the framing square on this point and slide the square into such position that each arm of the square indicates equal numbers on the opposite edge of the board. Draw the line on the outer edge and saw. This gives the slant for two boards. Repeat for the other two.

Cut each middle piece 2'11" long. Find the center at one end and place the square so that equal numbers are indicated on each arm. Nail these end boards to the base, then nail on the crosspieces *A*. Nail in the top ridge piece, forming a roof support. Saw and nail on the side boards, beveling the top pieces to a 45° angle as shown at *B* in the drawing.

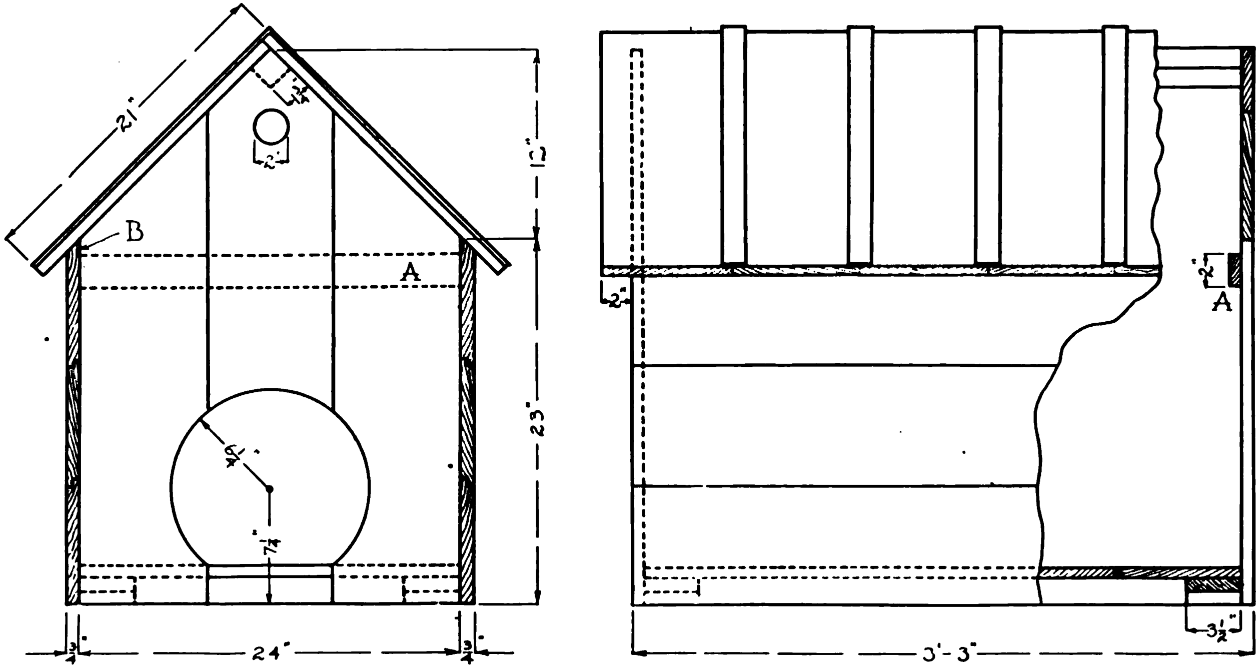
With the extension bit set at a 2" diameter, bore a hole in the middle and 5" down, on both ends. This affords ventilation. To mark off for the large opening at one end measure up 7¼", and using a compass set at a radius of 6¼" draw a circle, stopping at the floor line. Saw this out with a turning saw or a keyhole saw. If you have neither of these saws, bore out with a brace and bit; then use a chisel and cabinet file. This last method will naturally be slower.

Cut the roof boards, those on one side being 20¼" long and nailed flush with the ridge piece. The boards on the opposite side are 21" and they fit flush with the roof boards just nailed on. Cut out the strips which cover the joints and nail with shingle nails.

Paint to harmonize with the surroundings, or to match the color of other buildings nearby.

PLA

DOG KENNEL



MISCELLANEOUS.

Real carpentry is brought forward in the construction of the pergola and the summer house, while the gun cabinet affords work in cabinet-making. Being strictly a man's cabinet, the boy will be particularly interested in it. The chess board and the solitaire board provide close, exact work. Very beautiful boards may be constructed from these drawings.

CABINET FOR THE SPORTSMAN.

Where is there a boy or man who fishes, or traps, or hunts, who would not glory in the possession of a good cabinet for his paraphernalia? Hunting clothes, boots and shoes, guns, revolvers, fishing tackle, seines, baskets, loaded shells, cleaning apparatus, all can find a haven of security in this cabinet built for the purpose. It is attractive, and if finished nicely, can be placed in any suitable place in the house. Drawers and doors can be made to lock, thus insuring safety for the little folks in the home.

Two designs are given here, to suggest different ways of arranging the drawer space.

No. 1.

Material.

Four pieces ¾"x10"x12'.
Two pieces ½"x10"x14'.
One piece ½"x16"x10'.
One piece ½"x12"x12'.
Three pairs of butt hinges.
Three catches or knobs of some kind.

Bill of Stock. Finished dimensions.

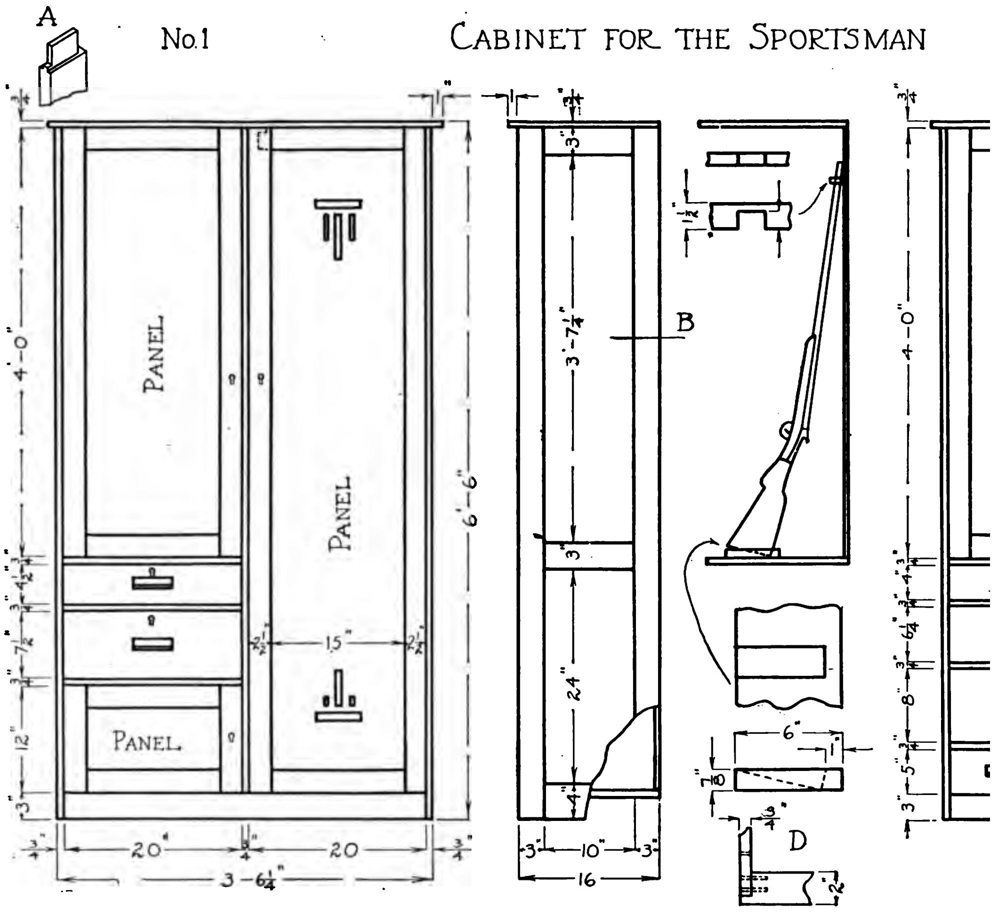
Four pieces ¾"x3"x6'5¼" for side panels.
pieces ¾"x3"x13" for side panels.
13" for side panels.
side panels.
One piece ¾"x17"x3'8¼" for top.
One piece ¾"x15½"x6'2" for middle upright partition.
One piece ¾"x15¼"x3'4¾" for bottom floor.
One piece ¾"x15½"x20" for floor below upper door.
Two pieces ¾"x2"x20" for drawer runners.
Four pieces ¾"x¾"x13½" for drawer runners.
Two pieces ¾"x2½"x6'2¼" for large door.
Two pieces ¾"x2½"x17½" for large door.
One piece ½"x15½"x5'9¾" for large door.
Two pieces ¾"x2½"x4' for smaller door.
Two pieces ¾"x2½"x17½" for smaller door.
One piece ½"x15½"x3'7½" for smaller door.
Two pieces ¾"x2½"x12" for smallest door.
Two pieces ¾"x2½"x17½" for smallest door.
One piece ½"x15½"x7½" for smallest door.
One piece ¾"x7½"x20" for large drawer.
Two pieces ½"x7½"x15¼" for large drawer.
One piece ½"x7"x19½" for large drawer.
One piece ¼"x15"x19½" for large drawer.
One piece ¾"x4½"x20" for small drawer.
Two pieces ½"x4½"x15¼" for small drawer.
One piece ½"x4"x19½" for small drawer.
One piece ¼"x15"x19½" for small drawer.
Eight pieces ½"x10"x3'5½" for back.
One piece ⅞"x6"x20" for gun base.

Tools. Saws, planes, gage, try-square, rule, framing square, chisel, brace, ⅜" bit, small drill, countersink, mallet, hammer, clamp, and plow.

Working Directions. In making this cabinet, first make the three paneled doors and the paneled sides; also the pieces with glue joints, which include the top and partition. The finished dimensions of each piece are given in the bill of stock. However, the long side pieces of each panel should be cut a little longer to allow for breaking or chipping off the ends. This extra length is sawed off after the panel is finished. The same method is employed in making all five panels, but only one, the large front door, is described. Notice the bill calls for the long side pieces of the panel to be ¾"x2½"x6'2¼". These are the finished dimensions. In order to allow for

No.1

CABINET FOR THE SPORTSMAN



and sides, rip out these
ed above. Plane a joint
er in the vise. To mark
from one end and mark
10", 1¾", and ⅜". Mark
the gage to 3/16" and gage
ıds, the head of the gage
the gage over ⅜" farther
ke the ⅜" mortises 1¼"
e ¾"x2⅝"x17½". Lay
made, being very careful
detail drawing *A*, so that
the end. The panel piece,
ed to ⅜" to fit the groove.
, which serves to ventilate
the pieces for the door,
ints. Do not use any glue
inet frame is finished, the
panel are cut down to fit

d the sides in like manner,
breaking the ends and side

rding to dimensions given,

side panel, where the ½"
out a rabbet ⅜" wide and
ards to fit up into the side
B.
per dimensions, nail in the
a particularly nice piece of
floor as shown in detail *C*.
nail in the middle partition.
for the drawers; then the
ıese runners is shown in the

detail drawing, *D*. Make and fit the drawers. The construction of the drawers is left to the worker, since they can be made in so many different ways.

Fit and hang the doors. The knobs or catches can be bought at any hardware store.

The detail will show the arrangement and construction of the pieces which are to hold the guns in place.

No. 2 illustrates another way of dividing the main frame of the cabinet.

PERGOLA.

This is a small pergola, easily constructed, and simple of design. Plant the beautiful climbing rose vines to cover it, or the hardy and useful grape vine. Either is beautiful, altho the rose is of slower growth in some climates.

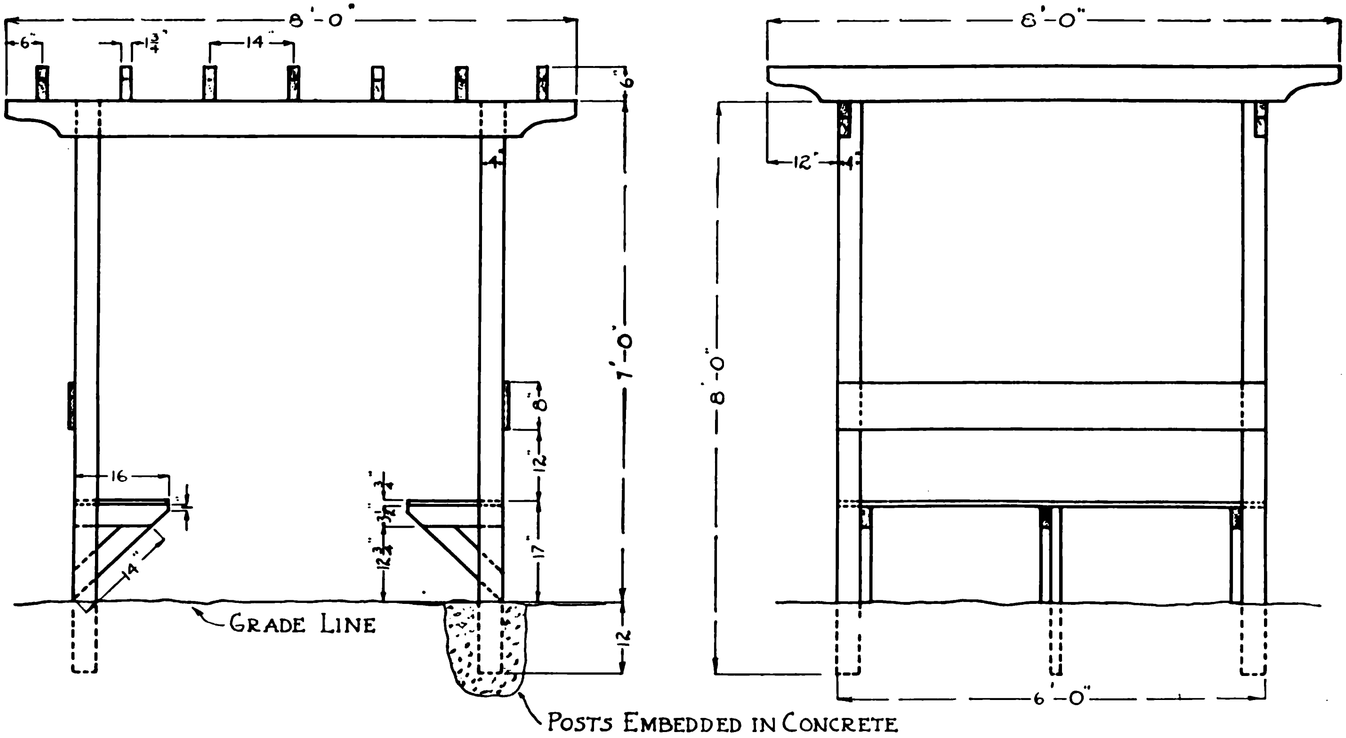
The pergola also serves well as a gateway between lawn and garden. The problem is simple enough for any boy to construct. Careful work and a good selection of paint will be required in order to make this the pleasing ornament that it should be.

Material. Yellow pine.
Two pieces 3½"x3½"x16'.
Nine pieces 1¾"x6"x8'.
One piece 1¾"x3½"x8'.
One piece 1¾"x3½"x14'.
Three pieces ⅞"x8"x12'.
Some 8d, 10d, and 16d common nails.

Bill of Stock. Finished dimensions.
Four pieces 3½"x3½"x8' for posts.
Nine pieces 1¾"x6"x8' for roof.
Six pieces 1¾"x3½"x16" for seat supports.
Six pieces 1¾"x3½"x14" for seat braces.
Two pieces 1¾"x3½"x2'5" for middle posts.
Two pieces ⅞"x16"x6' for seats.
Two pieces ⅞"x8"x6' for seat backs.

PLAT

PERGOLA



vel, framing square,

tches at the top of
the end and square
¾", gage around the
ough to allow a 2x6
. Cut a pattern from
curve or design you
. Lay out the design
w out with a turning
ff to 8′ in length first.
the outer edges. Lay

′ deep. Fill the hole
posts temporarily, to
evel the posts before
e 6′ long for a back

l on. Set or drive in
Miter six pieces of
races. To make the
eces of studding 16″
across the remaining
ner. Nail these sets
re nailing them to the
at of two 8″ boards.

many purposes. It
est in summer, par-
in a position to serve
ake some part of the

lawn more private and homelike. Roses, ivy or grapevines may be trained over the summer house, making it a thing o′ beauty and comfort.

Material. Yellow pine or spruce.

Four pieces 4″x4″x9′ for posts.
One piece 4″x4″x18″ for king-post.
Four pieces ⅞″x8″x12′.
Six pieces 2″x4″x12′.
Three pieces 2″x4″x10′.
Two pieces 2″x4″x8′.
Nine pieces ⅞″x4″x14′.
Three bundles of shingles.

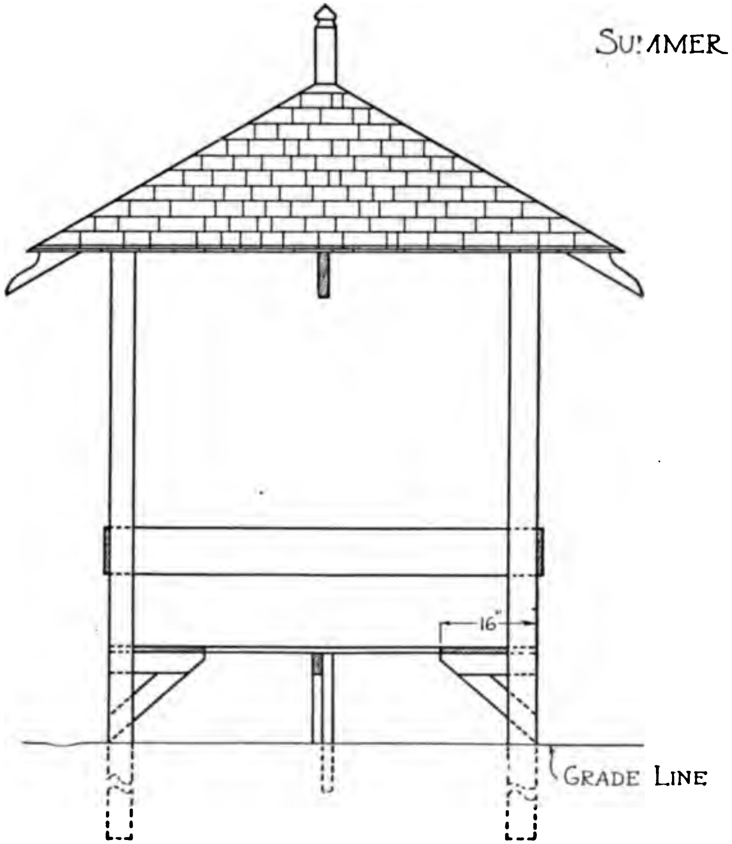
Tools. Saws, plane, framing square, T-bevel, rule, coping saw, turning saw, spirit level, and hammer.

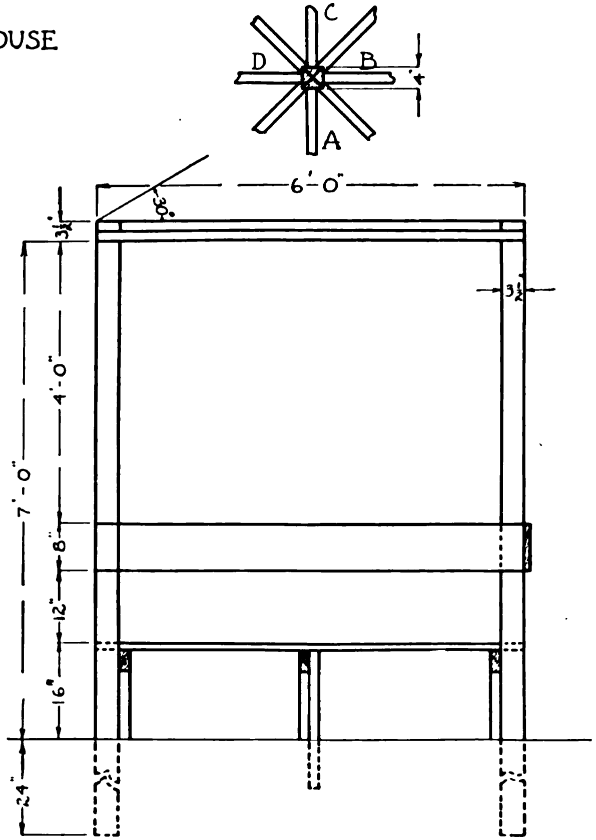
Working Directions. Lay out the holes for the four posts and dig them 2′ deep. Nail a piece of studding to the tops of two of the posts; set the posts into the holes and level them. Level the third and fourth posts from the posts already set. This is done by laying any straight piece, such as a 2x4, from one post to the other, putting the level on the 2x4 and raising or lowering the post until in the right position. Use two thicknesses of studding for the plate as shown in the drawing, toenailing and spiking to the tops of the posts with 16d nails. Pour in concrete around the posts to preserve them and to add stability to the structure.

Ordinarily the roof would be put on next but in this case the middle 2x4's would better be driven into the ground and the seats and back boards nailed securely into place so as to add strength to the structure while you are putting on the roof.

The rafters *A*, *B*, *C*, and *D* are made first. These are made to fit up against the king-post as shown in the detail. The four corner rafters fit over the posts and against the corners of the king-post.

SUMMER HOUSE





SOLITAIRE BOARD.

This board has been made in various forms for years. Grade boys are nearly always interested in the problem, and it gives good practice in accurate laying out and boring.

Material. Hard wood, preferably.

One piece ¾″x8″x8″ finished dimensions.
Two pieces 5/16″ dowels 30″ long.

Tools. Saw, plane, rule, try-square, brace, 5/16″ bit dividers, and pocketknife.

Working Directions. Work the piece accurately to ¾″x 8″x8″. The top and edges must be smooth. Be sure that at least one end and one edge are absolutely square. Find the middle of the edge and end, and with the try-square and pencil draw lines across the board. This gives the location of the center hole. On each of these lines, measuring from the center, mark off three ⅞″ spaces, and draw lines across the board, using the square. The locations are now marked, ready for the holes to be bored.

Lay off the square to an eight-sided figure. To do this set the dividers to one-half the diagonal, or the distance from the center to one corner, as *A* in the drawing. Using *A* as a center strike arcs at *C* and *D*. Then use *B* as a center to strike arcs *E* and *F*. Use the other corners in the same way. Connect the points just found, making the octagon. Saw off the corners and plane down to the lines. Lay off with a pencil gage a ¼″ chamfer, and then plane.

Make a bit guard by using a piece of wood ¾″ square, and almost the length of the bit. Bore thru from end to end with the bit to be used. These holes are ⅜″ deep. Measure up ⅜″ from the lips of the bit and mark on the piece of wood. Saw off the wood at this point. This makes a better guard than the steel ones that may be bought, because the wood is soft and will not mar the piece you are working on. Bore the holes and sand the entire surface.

The pegs are made as shown in the detail. The good work on the board must not be spoiled by poorly whittled pegs. Thirty-two pegs will be needed.

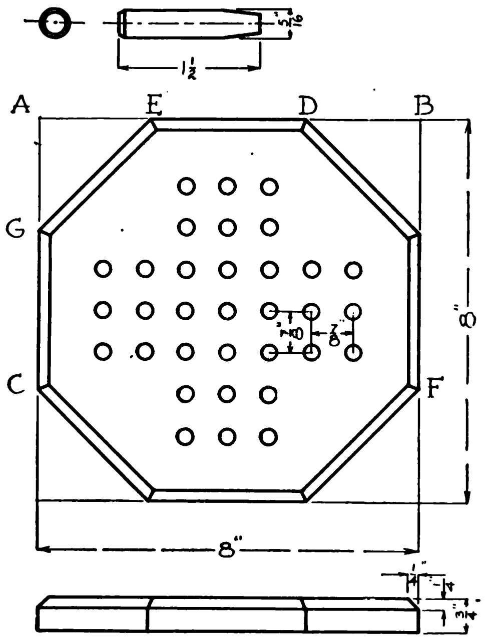
To play the game put a peg in each hole except the center. The problem now is to jump over each peg (as in checkers) in such a way that when the last jump is made the last peg will be in the center hole. This may seem simple, but before you conclude that it is easy, try it.

CHESS OR CHECKER BOARD.

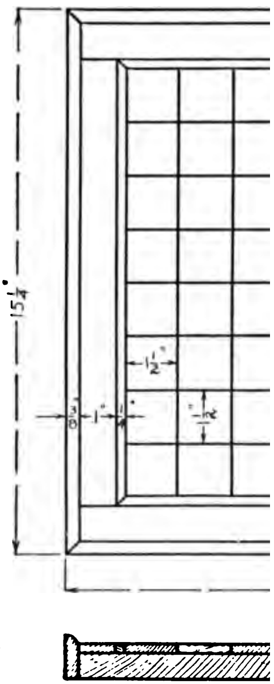
This problem is for the more capable student. Little need be said as to its construction, as the drawing and section show exactly what is to be done. Start by getting the bottom board exactly to dimensions. Then put on the outer border, mitering the corners. Fit in and glue the four 1″ strips, then the ¼″ mitered strips. Carefully fit in and glue the dark and light squares. The squares are cut from pieces 1½″ wide and several inches long. They must be finished very accurately.

Before beginning the problem be sure that you have in mind the kinds of woods to be used, and the exact place for each.

SOLITAIRE BOARD



CHESS



WIRELESS TELEGRAPHY.

A wireless telegraph outfit may not seem to be within the scope of manual training courses, but the teacher will readily see how an interest in manual training will be developed and held, when things which so appeal to the boy mechanic may be worked with. There is no question in the minds of teachers regarding the value of such interest, and there is also no question regarding the practical value to the boys who gain an understanding of a wireless telegraph outfit, and its construction. Few people realize how much of the apparatus it is possible to make in the shop. The parts presented in this book may be made, to great advantage, while the phones, key and some other parts of fine mechanism will have to be purchased. Books on wireless apparatus are advertised in magazines at small sums. These will assist greatly in learning the things that you need to buy, and also in learning how to use your apparatus when it is finished. The diagram given in this set of drawings shows how to "hook up" a sending and receiving set.

The wireless telegraph outfit will make an excellent class problem, the boys getting all the materials together for the masts and aerial which form the outdoor apparatus. These can be taken to the place in a vacant lot, or in some one's back yard, or on the school grounds where the apparatus is to be installed; and the class and teacher may meet when school is not in session to make this outdoor part of the apparatus. It is an entirely practical problem, and messages can be sent and received to and from long distances. The one with which the author is best acquainted was built and operated by one of his high school pupils in Dallas, Texas. This instrument received messages from ships in the Gulf of Mexico and in the Atlantic Ocean, from government weather bureau stations, as well as general messages from all over the country.

The young operator has a map of the United States and Canada, on which he marks the positions of different stations, and their call number. These he learns by adjusting the tuner and "listening in." As fast as new stations and calls are learned, he marks them on his map, thus giving him a comprehensive knowledge of the wireless system. The boy also talks to his friends here in the city who also have wireless apparatus, and to the boys in the neighboring towns. The apparatus is installed in the back yard of his home, and a small outside room of the house contains the apparatus which needs to be under shelter. This room also serves as the boy's den and study room, the apparatus requiring little space. It is a place of never ending interest to the boy himself and to his family and friends. Several other boys in the manual training classes have made their own wireless apparatus.

This set of problems will afford excellent opportunity for correlating the work of the physics and manual training classes. It may be possible to get the school officials to furnish the materials for the installation of a wireless station on the school grounds. This station can remain a permanent affair for use in the study of the physics classes, and it will serve as a pattern and guide from year to year for the boys who wish to install their own stations. All pupils of the school then have an opportunity of acquiring a knowledge of wireless telegraphy.

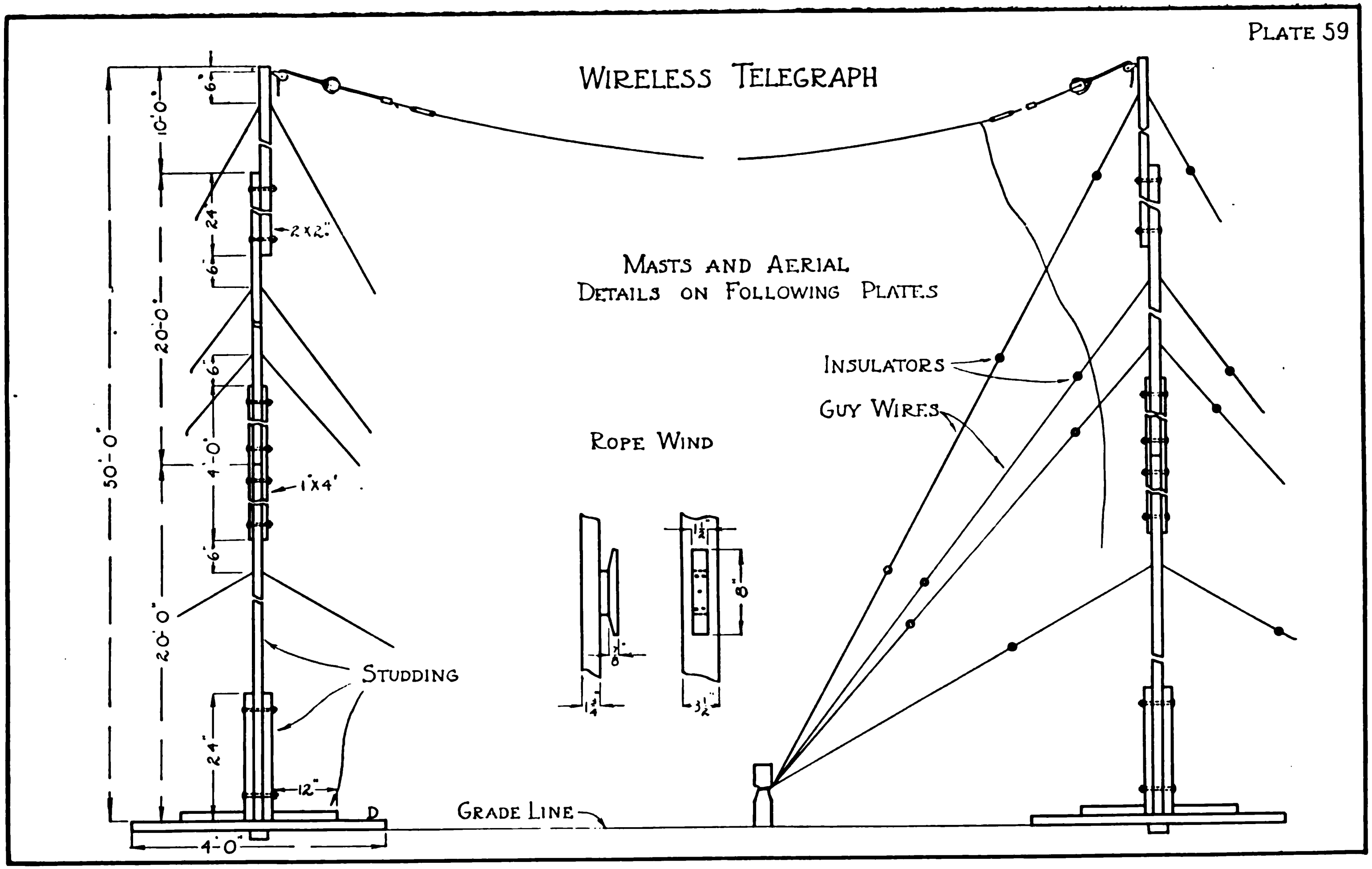
MASTS.

Material.

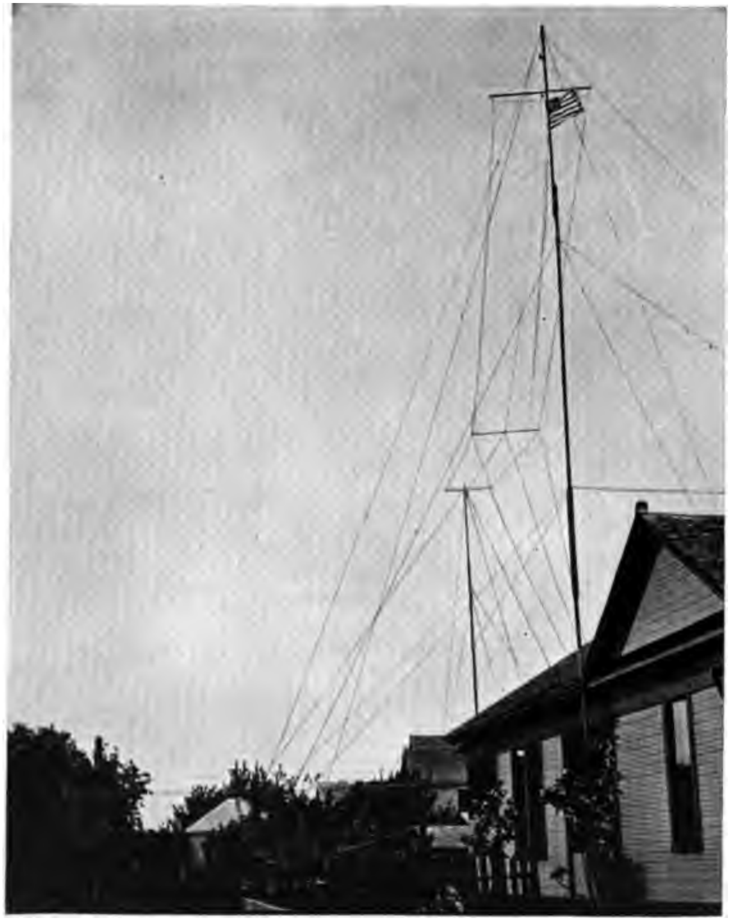
Four pieces 2"x4"x20'.
One piece 2"x4"x16'.
Two pieces 2"x4"x12'.
One piece ⅞"x4"x16'.
One piece 4"x4"x12' for stakes. Wires may be tied to convenient fence posts or buildings.
Four bolts ½"x5½" with washers.

PLATE 59

WIRELESS TELEGRAPH



MASTS AND AERIAL
DETAILS ON FOLLOWING PLATES



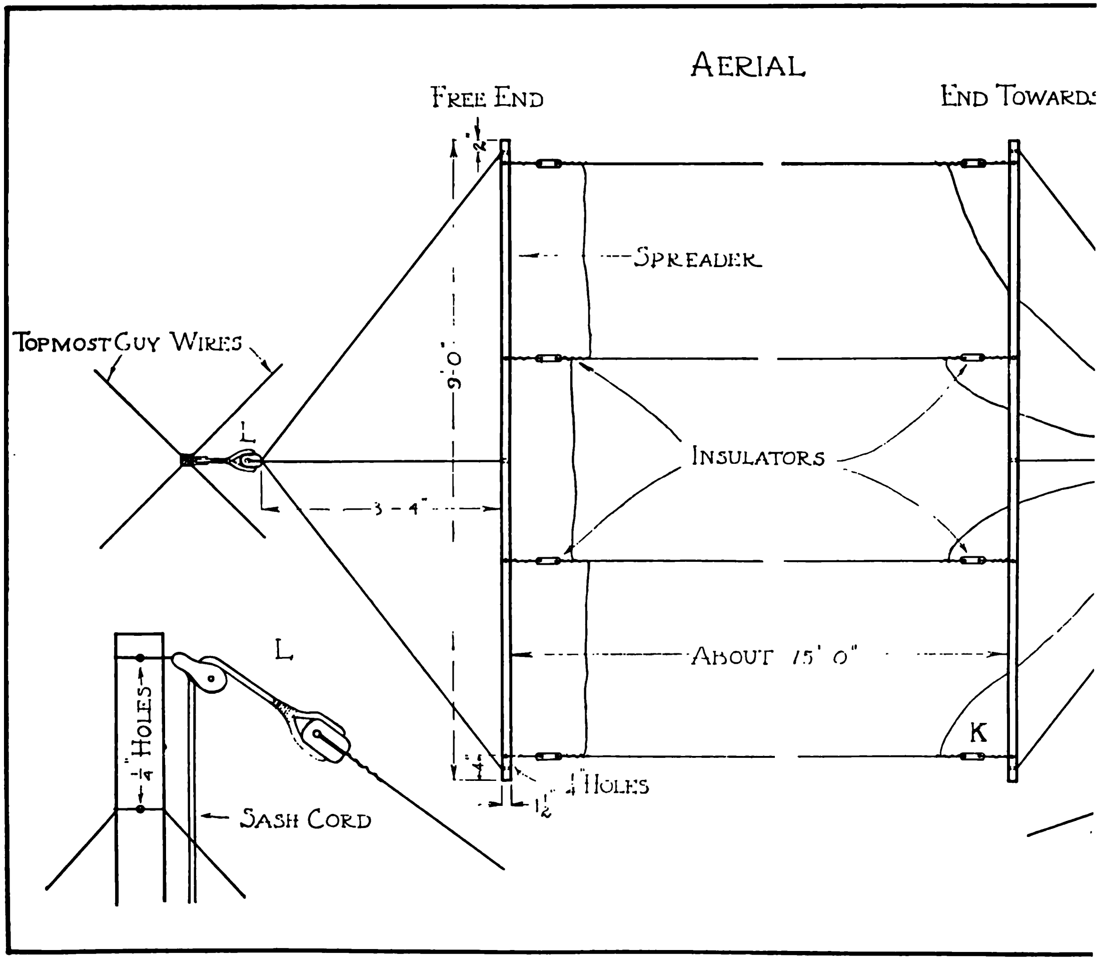
MASTS AND AERIAL.

Twelve bolts ½"x4" with washers.
Thirty-two small porcelain insulators for guy wires.
Two pulleys. (Almost any kind will do.)
One hundred and fifty feet of sash cord.
A quantity of No. 10 or 12 wire for guy wires. (Old telegraph wire will do.)
Some 16d and 20d common nails.

Tools. Saws, hammer, brace, ½″ and ¼″ bits, two pairs of pliers with wire cutting attachment, and framing square.

Working Directions. Study the drawing carefully; then the battle will be much more easily won. Rip a 12′ studding into 2x2's for the topmost pieces of the masts. Bore a ¼″ hole 1″ from one end of each 2x2, to use in wiring on the pulleys. Also bore holes 6″ farther from the end to use in fastening the topmost guy wire. Allowing a 2′ lap as shown in the drawing, nail the bottom end of the 2x2 to a 20′ studding. Bolt these pieces about 3″ from each end of the lap. Square the ends of two of the pieces of studding carefully, and butt them together to form a joint. Splice with boards 4′ long as shown in the drawing and bolt firmly. Cut a 4′ piece of studding and spike this onto the bottom of the mast as at *D*. Bolt and spike on the other pieces of studding as shown in the drawing. One piece of 4′ studding is buried under the ground and is not nailed on at this time. The mast part is now finished. Wire on the pulleys. Do all work well, since any poor work will necessitate taking the mast down.

Now proceed to do the wiring. There are four wires at each point, but only two are shown here. First, make ready the topmost guy wires. Notice in the drawing there are three "breaks" in these wires, where three insulators are put in. These insulators are very necessary, since they keep the waves which are very faint from going into the ground. The lengths of these guy wires will depend upon the distance to the anchors. Be sure that you have at least 50′ in each wire. Bore ¼″ holes at the places on the mast where guy wires are attached. Push the end of the wire thru the hole, bring together, and


AERIAL
FREE END
END TOWARDS
2"
9'-0"
SPREADER
TOPMOST GUY WIRES
L
INSULATORS
3'-4"
ABOUT 15' 0"
K
4"
1/4" HOLES
1 1/2"
L
1/4" HOLES
SASH CORD

twist to hold. This does not show in the drawing. The wires in the second set have two breaks and are attached 12'6" from the top. The wires in the third set have two breaks and are attached 27'6" from the top. The wires in the fourth set have one break, and are attached 16' from the base. Any sort of insulator of the smaller type may be used for the breaks. A lot of these may usually be found around old electric lighted buildings that are being torn down, old telephone poles, and almost any place where you find electric and telephone wires. The guy wires should be about No. 10 or No. 12. Old telephone or telegraph wire will serve admirably. Attach a rope to the pulley at the top, make sure that all the guy wires are in place, and you are ready to elevate the mast. Place the mast in the desired position and drive some stakes into the ground to hold the mast in place while raising it. One boy is needed for each of three of the four guy wires, one wire trailing loose at first. A fourth boy helps push up the mast with a long pole which has a spike in the end. Elevate the mast as much as possible before pulling on the guy wires, since the mast is light and may break under the strain. When once perpendicular and all guy wires pulled to equal tension, the mast will stand in almost any gale.

The masts should be set about 75' or 80' apart. Our laws require that for amateurs, the wave length must be not more than 200 meters, thus the above distance is about correct. If you are installing only the receiving apparatus, the distance between the masts may be any length.

AERIAL.

Material.

Two pieces ⅞"x1½"x9' for spreaders.
[illegible] porcelain insulators for *K* in the drawing.
[illegible] for *L* in the drawing.
[illegible] wire.

Working Directions. Study the drawing very carefully, then the construction will be easy. Choose pieces of wood which are tough and free from knots. Bore ¼" holes 4" from each end. Divide the remainder into three lengths of 2'10", and bore ¼" holes. Also bore ¼" holes edgewise of the pieces, 2" from each end and in the middle, to use in fastening the three wires which attach to the insulator. You now have prepared the two pieces of wood which form the arms of the "spreader." You will then proceed to arrange the wiring of this part of the apparatus.

Wire the four porcelain insulators onto each arm of the "spreader" as shown at *K* in the drawing, being sure that the wires are so twisted as to pull on the whole piece of wood. Put in the four aerial wires, being sure they are of equal length. At the "free end" connect these four wires with each other as shown in the drawing. At the other end of the middle, attach a wire to each of the four wires. These four wires just attached are called the "lead in," and are to be carried to the instrument. Twist them together and insulate well with insulating tape. The "lead in" is 50' long plus the distance to the instrument. Now attach the three guy wires to each arm of the spreader, and fasten these to the large insulators, one at each end of the aerial; and attach to each mast, as shown at *L* in the drawing. Your aerial is now completed. Attach the two large insulators, one of which is shown at *L*, to the ropes which roll over the pulleys, shown also in detail at *L*. You may now pull the aerial into its position at the top of the masts. The outside part of your wireless apparatus is now complete.

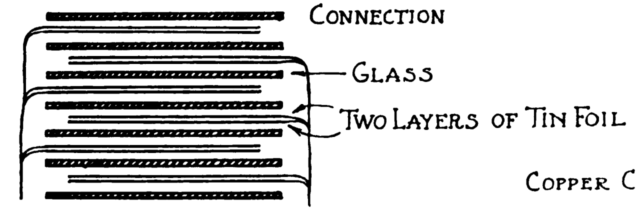
HIGH TENSION CONDENSER.

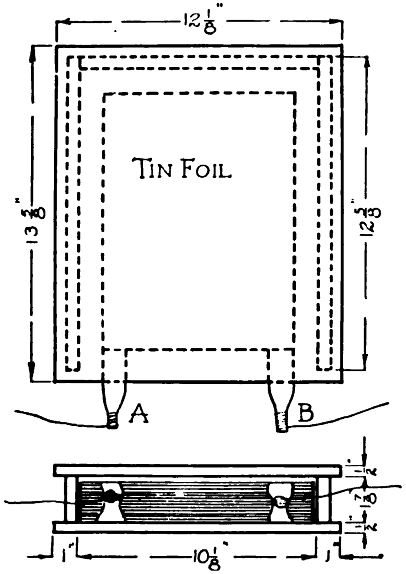
Material. For box. Mahogany or birch.

Two pieces ½"x12⅛"x13⅝" for top and bottom.
Two pieces ½"x1⅞"x12⅝" for sides.
One piece ½"x1⅞"x10⅛" for end.
Ten 1" No. 9 round-head brass screws.
Some 1¼" brads.

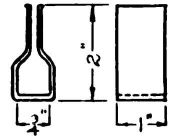
HIGH TENSION CONDENSER

ILLUSTRATION TO SHOW CONSTRUCTION AND CONNECTION

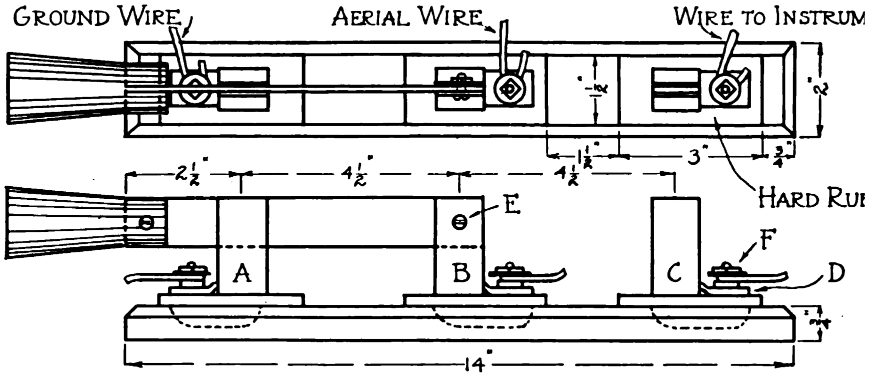




COPPER CLIP FOR A, B, C.

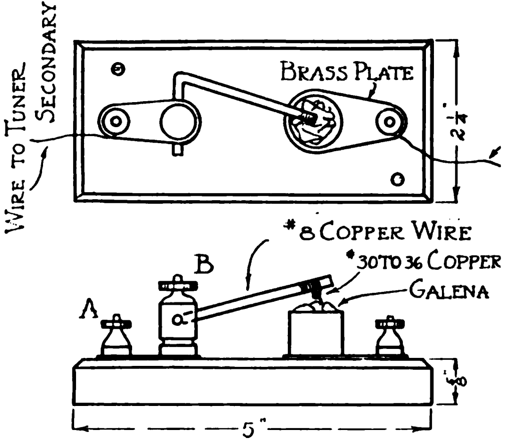


LIGHTENING SWITCH



DETECTOR

PLA



twist to hold. This does not show in the drawing. The wires in the second set have two breaks and are attached 12′6″ from the top. The wires in the third set have two breaks and are attached 27′6″ from the top. The wires in the fourth set have one break, and are attached 16′ from the base. Any sort of insulator of the smaller type may be used for the breaks. A lot of these may usually be found around old electric lighted buildings that are being torn down, old telephone poles, and almost any place where you find electric and telephone wires. The guy wires should be about No. 10 or No. 12. Old telephone or telegraph wire will serve admirably. Attach a rope to the pulley at the top, make sure that all the guy wires are in place, and you are ready to elevate the mast. Place the mast in the desired position and drive some stakes into the ground to hold the mast in place while raising it. One boy is needed for each of three of the four guy wires, one wire trailing loose at first. A fourth boy helps push up the mast with a long pole which has a spike in the end. Elevate the mast as much as possible before pulling on the guy wires, since the mast is light and may break under the strain. When once perpendicular and all guy wires pulled to equal tension, the mast will stand in almost any gale.

The masts should be set about 75′ or 80′ apart. Our laws require that for amateurs, the wave length must be not more than 200 meters, thus the above distance is about correct. If you are installing only the receiving apparatus, the distance between the masts may be any length.

AERIAL.

Material.

Two pieces ⅞″x1½″x9′ for spreaders.
Eight porcelain insulators for *K* in the drawing.
Two large insulators for *L* in the drawing.
A quantity of about No. 14 copper wire.
Some insulator tape to insulate the "lead in".

Working Directions. Study the drawing very carefully, then the construction will be easy. Choose pieces of wood which are tough and free from knots. Bore ¼″ holes 4″ from each end. Divide the remainder into three lengths of 2′10″, and bore ¼″ holes. Also bore ¼″ holes edgewise of the pieces, 2″ from each end and in the middle, to use in fastening the three wires which attach to the insulator. You now have prepared the two pieces of wood which form the arms of the "spreader." You will then proceed to arrange the wiring of this part of the apparatus.

Wire the four porcelain insulators onto each arm of the "spreader" as shown at *K* in the drawing, being sure that the wires are so twisted as to pull on the whole piece of wood. Put in the four aerial wires, being sure they are of equal length. At the "free end" connect these four wires with each other as shown in the drawing. At the other end of the middle, attach a wire to each of the four wires. These four wires just attached are called the "lead in," and are to be carried to the instrument. Twist them together and insulate well with insulating tape. The "lead in" is 50′ long plus the distance to the instrument. Now attach the three guy wires to each arm of the spreader, and fasten these to the large insulators, one at each end of the aerial; and attach to each mast, as shown at *L* in the drawing. Your aerial is now completed. Attach the two large insulators, one of which is shown at *L*, to the ropes which roll over the pulleys, shown also in detail at *L*. You may now pull the aerial into its position at the top of the masts. The outside part of your wireless apparatus is now complete.

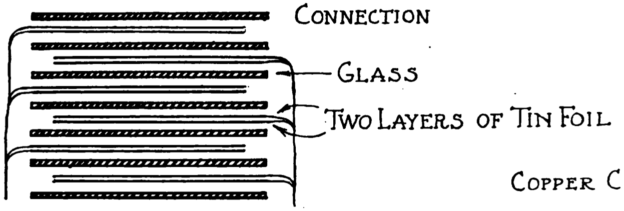
HIGH TENSION CONDENSER.

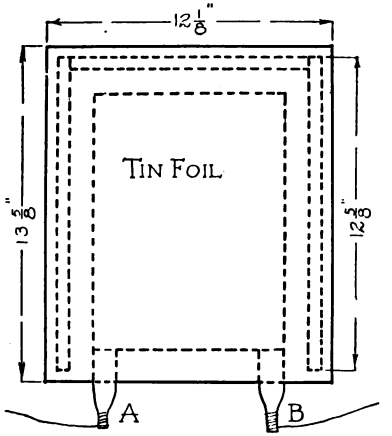
Material. For box. Mahogany or birch.

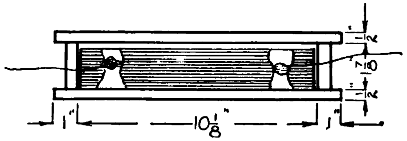
Two pieces ½″x12⅛″x13⅝″ for top and bottom.
Two pieces ½″x1⅞″x12⅝″ for sides.
One piece ½″x1⅞″x10⅛″ for end.
Ten 1″ No. 9 round-head brass screws.
Some 1¼″ brads.

HIGH TENSION CONDENSER

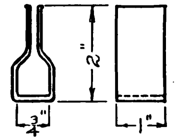
ILLUSTRATION TO SHOW CONSTRUCTION AND CONNECTION



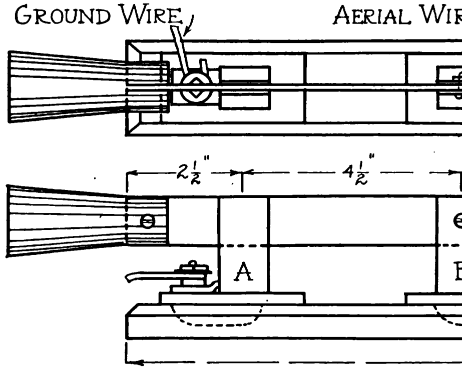


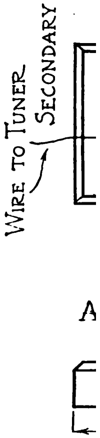


COPPER CLIP FOR A,B,C.



LIGHTENING SWITCH





Material. For condenser.

Twelve pieces of ⅛" glass 10"x12".
A quantity of tin foil, to make pieces 8"x10".
Vaseline.

Working Directions. The box may be easily constructed by working the pieces to dimensions given in the list of materials. Since this is to be part of your permanent wireless set it should be nicely finished. One end is left open altho it may be closed and holes left for the lugs to come thru. Nail the pieces onto the bottom and sides, but put on the top with screws so it may be taken off without disturbing the glass and tin foil.

The making of the condenser is a simple matter, but it must be well done to get accurate results. The condenser consists of layers of glass and tin foil arranged in definite order, and connected by projections or lugs, one from each layer of tin foil. The pieces of glass are 10"x12". The layers of tin foil are 8"x10", with the "lug" or projection left on one corner of each layer, to extend out of the box. These "lugs" or projections of tin foil are arranged alternately in the box, and are squeezed together and wrapped around with wires at *A* and *B*.

On the bottom of the box place one piece of glass without any further preparation. We will call this piece of glass a blank. There is one other blank piece of glass to be put on the top after the other pieces have been prepared and laid into the box.

To prepare the other pieces of glass and the tin foil, forming a plate, proceed as follows: Spread vaseline evenly over each side of the glass, being careful to leave no dry spots. Place a layer of tin foil on each side of the greased glass, spacing it accurately with 1" margin all around the tin foil as shown in the drawing. The lug of one layer of tin foil projects on the left, while the lug on the next layer of tin foil projects on the right of the "plate" being made. Smooth the tin foil down carefully with a rubber roller or something similar, a small round bottle or even the thumb nail. Be careful that the tin foil lies smooth and flat with no air bubbles.

Build the remaining plates in the same manner, being sure always that the lugs project alternately. Lay the prepared plates in the box, and lay a blank glass over them.

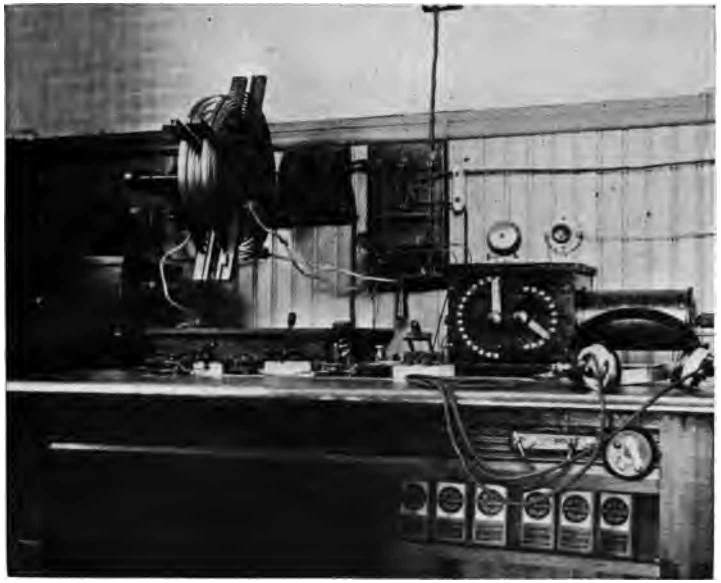
Connect the projecting lugs as follows: The lug from the bottom sheet of tin foil leads out from corner *A*, and the lug from the top layer of tin foil on this same plate leads out at corner *B*. Next, the bottom lug of the second plate leads out at corner *B*, and the top lug from corner *A*, and so on until all the layers of tin foil are connected. Study the drawing very carefully to get this point well in mind. You will see that the two sheets between each glass are connected from the same corner, thus making the electrical connection accurate. Ten plates prepared as given here will be enough under ordinary circumstances. The wires which wrap the lugs of tin foil lead to the side of the step-up transformer.

DETECTOR.

Material.

One piece ⅝"x2¼"x5" birch or mahogany.
Two binding posts like *A* in the drawing.
One binding post like *B* in the drawing.
Two brass plates.
A container for the galena. This one was the end of a burn out cartridge fuse.
One piece No. 8 copper wire 3½" long.
A short piece of No. 30 to 36 copper wire.
A small amount of galena.
Two or four round-head screws for fastening the base onto the table.

Working Directions. No measurements have been given in this problem except for the base, since these parts may be easily placed when all your material is at hand. The two end binding posts are to attach the wires to, one wire to the phones



WIRELESS STATION.

and the other to the secondary of the tuner. The large binding post holds the large wire and the two brass plates form connections, one with the large and small binding posts and the other with the galena cup and small binding post. A small amount of galena may be obtained from a wireless supply house. It usually costs 10c an ounce. An ounce is much more than needed, and the extra amount may be stored away so that if the galena in the cup gets dirty or is lost a new supply may be added. The binding posts may be found lying around telegraph stations an kept.

L

The lightening s the operator to gr tects the delicate lightning.

Material.

One piece
Three piec
One dozen
Three copp
x1″x5″.
Three piec
One piece
One handle
arm.
One small
Three fast
stove bol

Working Direc of this problem e kind of binding po of the drawing an making the switch

Plane, chamfer

Fasten the binc rubber pieces, usir tightening, and als *B*, and *C*. (Look meter in any hom of this switch m same.) Now tha are to hold the w see that they cannot lie flat on the wood base on account of the binding post projecting underneath the hard rubber piece. To overcome this, cut out a hollow place in the wood base directly under the hard rubber piece so that you are very sure that the metal does not in the least touch the wood base. Now screw the three clips onto the three hard rubber pieces as shown in the drawing, being very sure that they line up correctly so as to allow the switch arm to fit into each of them. Screw each of the hard rubber pieces into its position as shown in the drawing. If you make the handle of the switch arm of wood, paint it black, and shellac heavily. Shellac is a good insulator. Screw the switch arm onto clip *B* as in the drawing.

OSCILLATION TRANSFORMER.

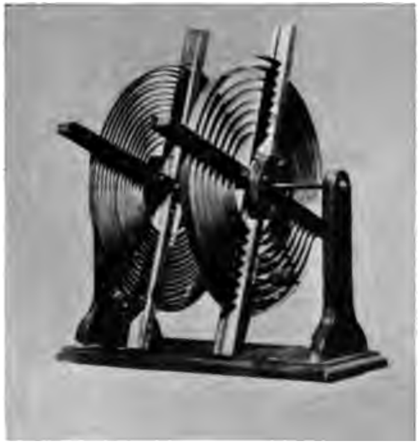
Material. Birch or mahogany.

(1) One piece ¾"x6"x15".
(2) Two pieces ⅝"x5"x8⁵⁄₁₆".
(3) Four pieces ½"x⅝"x16".
(4) Four pieces ¼"x½"x16".
(5) Two pieces ½"x3"x3".
(6) One brass rod ¼"x13½".
(7) Four brass or copper clips as shown in detail.
(8) Fifteen feet of brass tape ¼" wide.
(9) Ten feet of brass tape ½" wide.
(10) Sixteen screws ¾" No. 7, round-head blued.
(11) Four screws 1½" No. 9, flat-head.

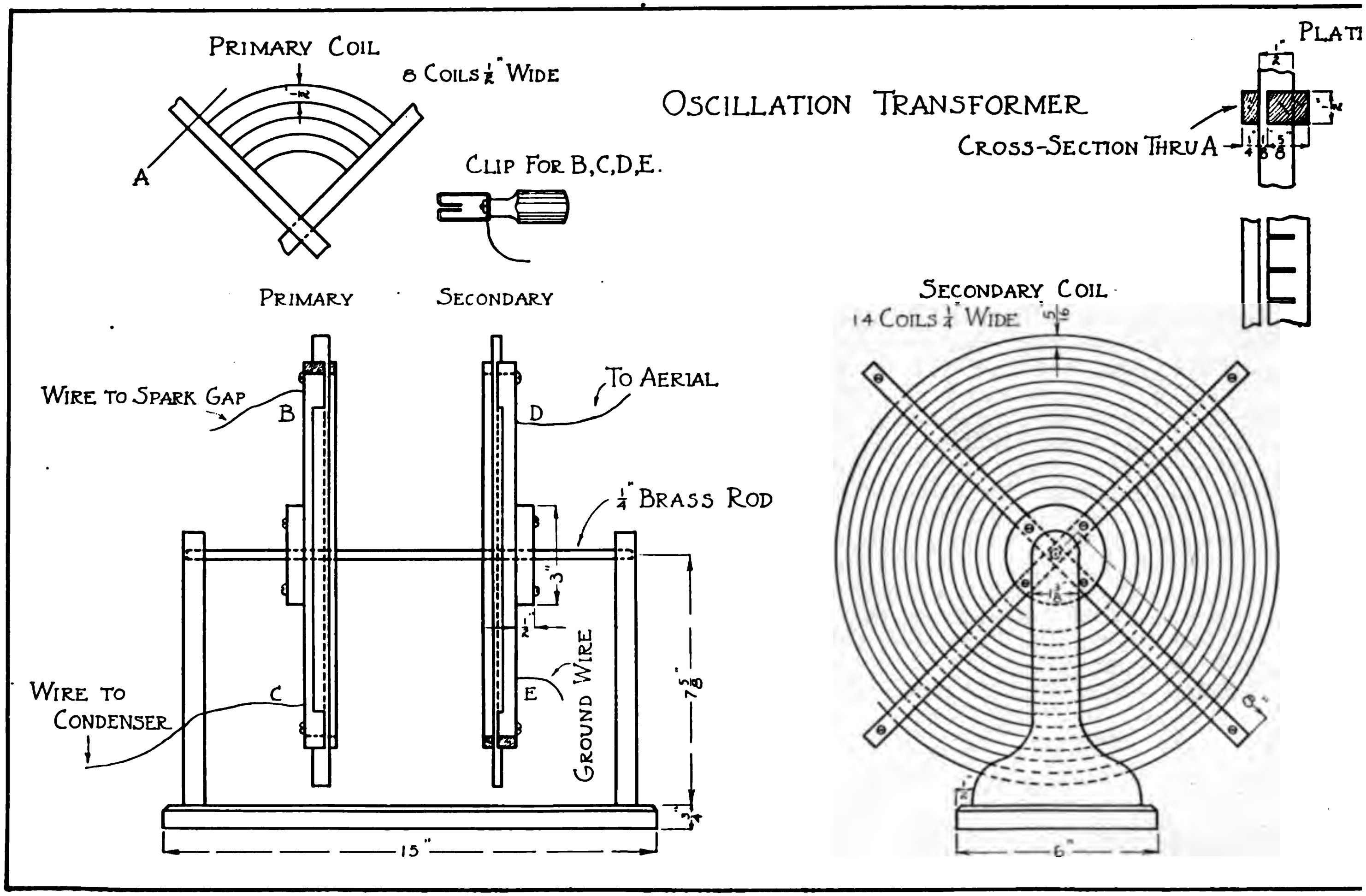
Tools. Saw, plane, backsaw, brace, ¼" bit, small drill for screws, compass, rule, screwdriver, and pliers.

Working Directions. Since this instrument is to become a part of your permanent set of wireless apparatus, you will wish to do very accurate and careful work. The problem is in two parts, the transformer and the stand which holds it.

Make the transformer first. Plane to dimensions Nos. 3 and 4, in list of materials, also work No. 5 down to a diameter of 3". Take two pieces, ½"x⅝"x16", and make a cross-lap joint. These crosspieces hold the tape coils. Also make a cross-lap joint on the ¼"x½"x16" pieces. These crossed pieces fit against the first one to hold the coils in place. The remaining pieces are worked in the same way. Make the secondary coil first. Take one of the ½"x⅝" pieces, find the center, and measure out 2" on one of the four arms. On the next arm to the right measure out 5/64" farther. On the third arm measure out 5/64" farther yet, and on the fourth arm measure 5/64" still farther. When you come back to the point first marked on arm No. 1, measure out ⁵⁄₁₆" from this point and mark again. Now using each of these points as a starting point, measure with a rule on each arm thirteen spaces more, each ⁵⁄₁₆" apart. This marks the points for the spiral.



OSCILLATION TRANSFORMER.


OSCILLATION TRANSFORMER
PRIMARY COIL
8 COILS ½" WIDE
½"
A
CLIP FOR B,C,D,E.
PLATI
½"
½"
CROSS-SECTION THRU A
¼" 3/8" 5/8"
PRIMARY
SECONDARY
WIRE TO SPARK GAP
B
C
WIRE TO CONDENSER
D
TO AERIAL
¼" BRASS ROD
3"
½"
E
GROUND WIRE
7 5/8"
¾"
15"
SECONDARY COIL
14 COILS ¼" WIDE
5/16
1 3/8"
8"
½"
6"

Saw with back saw down ⅛" at each of these marks. Put on the circular wood pieces with a screw in each arm. Start the ¼" brass tape at the 2" mark and slip the tape into each saw kerf that has just been made, until either you have exhausted the tape or have on all you need. There is no exact amount of tape to be designated, since it depends upon your station. Fit one of the ¼" crosses over this to hold the tape in place and put in a screw at each end.

The primary coil is made in the same way except that the brass tape is put ½" apart and the saw kerfs are made ⅜" deep. This is shown in the detail.

Bore a ¼" hole thru the center of each coil for the brass rod.

Plane to dimensions the base piece, also work out the two end pieces to something like the design in the drawing, and bore a ¼" hole about ⅜" deep in each piece, 7⅝" up from the lower end. Bore holes for the screws in the base and use the countersink to sink the head below the surface. Slide the coils onto the brass rod, fit the brass rod into the two supports and fasten the screws into the base. If the transformer is to be attached to the wall, four screw holes will need to be made.

There are many ways of making the clips, and the one shown here need not be followed. The handle is made of hard rubber, the clip is made of thin copper tape bent in the manner shown, and fastened to the rubber handle with a screw, nut, etc. The clips are fastened to the coil at *B*, *C*, *D*, and *E* or thereabouts. They are changed frequently.

A mahogany finish looks well on the wood parts of the apparatus.

TUNER.

Material. Mahogany or birch or any wood without acids, etc.

One piece ¾"x8"x24".
One piece ½"x8"x3'6".
Two brass rods 3/16"x15¼".
Three switch arms as at *A* in detail.
Four binding posts.
Thirty-two contacts as at *C*. These may be gotten from the National Carbon Co. This company makes Columbia Dry Cells.
Fourteen 1" brass round-head screws.
A quantity of No. 24 SCC (single cover cotton) wire for primary coil.
A quantity of No. 30 SCS (single cover silk) wire for secondary coil.
One paper tube 4¼" in diameter and 6¾" long.
One paper tube 3½" in diameter and 5¾" long.
Shellac.
Some nails.

Bill of Stock. Finished dimensions.

One piece ¾"x7½"x18" for bottom.
One piece ½"x7"x8" for top.
Two pieces ½"x5½"x7½" for sides.
Two pieces ½"x5½"x5½" for ends.
One piece ½"x2"x3½" for *Z*.
One piece ¾"x4"x4" for secondary coil.
One piece ½"x3¾"x3¾" for secondary coil.
One piece ½"x4"x4" for primary coil.

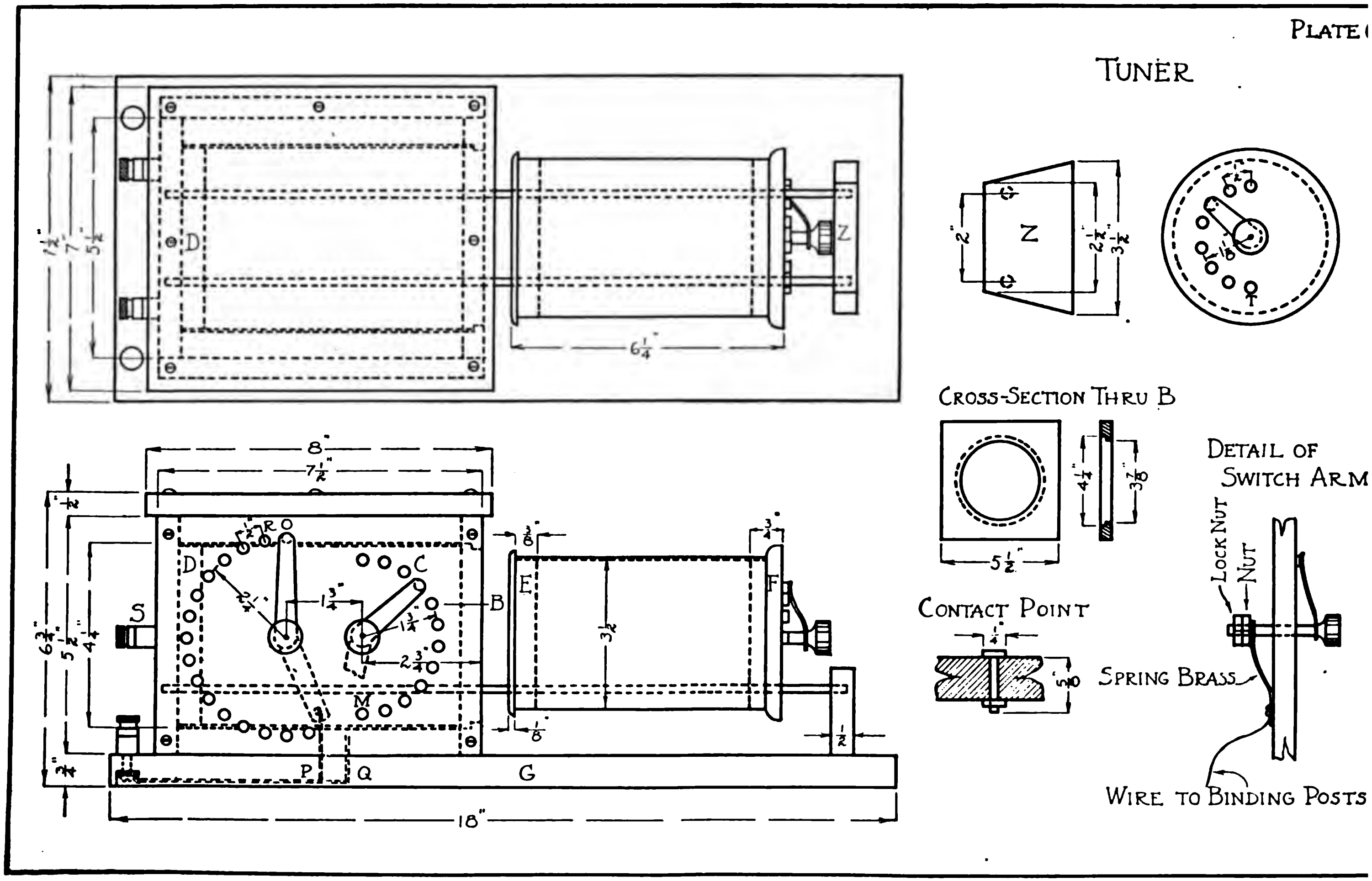
Tools. Saws, planes, brace, several small drills, gimlets, gage, screwdriver, lathe, and lathe tools.

Preliminary Remarks. This whole piece of apparatus will take careful study and careful work. A lathe is almost a necessity if nice work is to be done on the coils, or framework that holds the coils. However, these can be made with ordinary tools, but with considerable disadvantage. The whole piece of apparatus is made up so as to manipulate the two coils, the primary coil that remains stationary on the inside of the box, and the movable secondary coil. The primary coil is connected with the aerial and the secondary coil to the phones, detector, etc.

Working Directions. Little need be said about the making of the box if the bill of stock is followed carefully and

PLATE

TUNER


D
Z
6¼"
7½"
7"
5½"
N
2"
2¼"
3½"
CROSS-SECTION THRU B
5½"
4½"
3⅞"
DETAIL OF SWITCH ARM
LOCK NUT
NUT
SPRING BRASS
WIRE TO BINDING POSTS
CONTACT POINT
¼"
5/16
8"
7½"
½"
6¾"
5½"
4¼"
¾"
R
C
D
B
S
1¾"
1¾"
2¾"
M
P
Q
G
18"
E
F
⅜"
¾"
3½
⅛"
½"

details. The only
F, and *G* that pro-
ircular piece, *B* is a
g bored from each
shown in the detail.
the drawing. Cut
the underneath sur-
he left hand binding
nd binding post.
orts the secondary

s the making of the
first. Take a paper
' long. Some brands
per tubes which are
l end and wind to-
arefully in winding
right end loose, for
the tube. Make one
f slack and twist it
ther turn and bring
ntil thirteen pigtails
d on the tube. Now
off a tap until the
ntinue this process,
until fourteen more
e left on the tube.
p at the middle point
followed there will
trouble from bad
e given a heavy coat

each end for fasten-
the tube into eight equal parts. Punch a small hole thru the tube at each division point. Begin winding by sticking about 6″ of wire thru the hole to the left and then wind carefully and smoothly towards the right until the next hole is reached. Make a pigtail here long enough to reach about 2″ outside of the other end of the tube. This pigtail leads thru the small hole you have punched in the tube to the inside hollow space. Continue this process until the tube is wound completely making a pigtail at each hole punched in the tube. Be very careful to wind this on smoothly as it is outside and can be seen. Give this a heavy coat of shellac. This completes the winding of the tubes.

At this point, put all the pieces of woodwork together to be sure that they fit accurately. Use screws for this, since the pieces must be taken apart again for further work. When you are sure all is accurate, take the pieces apart, stain with mahogany and give several coats of shellac to all except the front board.

Now prepare to lay off on the front board the points for the brass contacts which connect with the pigtails of the primary coil which you made first. To lay off these points, draw a line lengthwise thru the middle of the piece of wood. Study the drawing carefully to get the exact positions on this line for the centers of the two switch arms. Get these points right. Draw lines across the board at each point. Draw the larger semicircle with a 2¼″ radius and the smaller one with a 1¾″ radius. For the large semicircle set the dividers to ½″ and mark sixteen points. This should complete a perfect semicircle, but if it is not exact, experiment a little and get the exact spacing. Lay off the other two sets of contact points in the same way. Bore holes the size of the shank of the contact.

The best way to connect these pigtails to the screws is to solder them, but an easier way is to make a loop or hook on the end of the pigtail to pass around the end of the screw, and put a nut down on top of it to hold it tight. After twelve pigtails have been connected the right hand switch will be completed. Now connect the thirteenth pigtail left in the first set with the top contact point at *O*. Connect the first of the twelve-turn pigtails or taps to the next contact point *R*. Continue connecting taps until all have been connected.

A short explanation of the method of winding and connections known as the Navy type may be appreciated. When both switches are turned to the top there is only one turn of wire in the circuit. Now as the right hand switch is moved down towards the bottom it connects another turn in the circuit for each contact point used. If turned down to *M* there are twelve turns in the circuit. Now if the left hand switch is turned to *R* there is added a twelve-turn group, making twenty-four turns in the circuit. If the right hand switch is turned back to the top point, the number of turns in the circuit is decreased from twenty-four to thirteen. Using this method, any number of turns from one to the entire number of turns on the tuner may be connected in the circuit simply by turning the two switches. Supposing you want fifty turns, set the left hand switch on the fourth contact point, giving forty-eight turns, and the right hand switch on the second contact point, giving two more turns. As the number of turns in the circuit is increased, the wave length of the receiving station is increased. Thus different stations having different wave lengths may be tuned in. The secondary coil which rests on the two brass rods, is movable.

In connecting this secondary, lay out the end switch, as shown in the detail, following the same plan as in the other switches. The end of the wire on the left hand side leads to one of the secondary binding posts marked *S* in drawing. This connection may be most easily made by running a piece of ordinary lamp cord from the binding post thru holes bored in piece *E*, when the secondary is pulled out as far as it will go. Tie a knot in the lamp cord on the inside of the secondary and

connect this lan
winding. The
the tube connec
the first contact
nect the rest o
mary. Connect

posts, using m
connections to t

The tuner ma
very easy since

In using the
length desired t
by experiment.
coupling, that is
loudest signals
in the primary
takes a short ti
wireless station
results at once.

turn immediately
is is a very simple
one ready made is

have the insulation
gh tension sending
arrying parts are
the base. A hole
h fasten down the

gany.

for *X*, *Y*, and *Z*.
K.
F.
E.

's.
drawing.

f wood to dimen-
Eight clips are
These may be ob-
n be made in the
ips onto the hard
to the wood with
the drawing. Be
h of the machine

s, two long blades
Then insert the

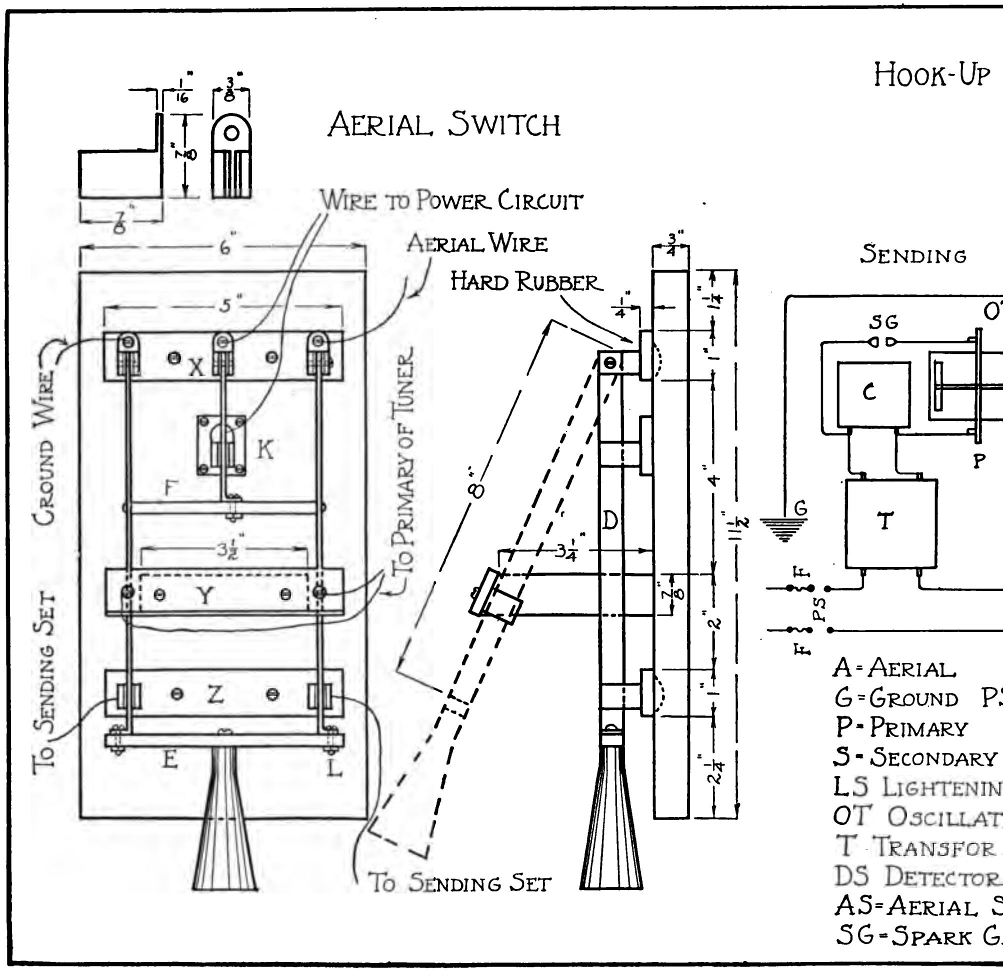
three blades in the clips at the back of the switch, and fasten them with the brass bolts. Be sure to locate clip *K* so that when the switch is thrown into receiving, the short blade will be pulled entirely out of the clip to open the circuit in which it is connected.

Now fasten the clips on the two front strips of rubber, spacing them the same distance apart as in the back strip. Locate the strip *Z* on the wood base so the switch will easily throw into the clips. If dimensions have been followed accurately, this is easily accomplished. Fasten the clips onto the hard rubber strip *Y*. Fasten strip *Y*, clips downward, onto the wood uprights in the slanting position shown in the drawing. Be sure that no current carrying part touches wood.

HOOK UP OF WIRELESS STATION.

Presuming that all instruments have been made or procured, it is time to connect them. Run the wire from the aerial or the lead in, as it is called, to the middle point, or the blade of the lightening switch. The lightening switch should be placed outside, but if this is not convenient it may be placed inside with little risk of damage. Connect a heavy copper wire, No. 4 preferably, from one side or jaw of the lightening switch to the ground, as at *G* in the diagram. From the other side or jaw of the lightening switch run a heavy copper wire to one blade of the aerial switch, called aerial wire in the drawing of the switch. From the other blade of the aerial switch a heavy wire is run into the ground. A ground connection is best made by fastening the wire to a water pipe by means of a ground clamp or by soldering. It is understood that all these wires carry high tension current and should be thoroly insulated. They should be run on porcelain insulators.

We will now hook up the receiving set which is entirely separate from the sending set. Connect one of the clips on the


HOOK-UP
AERIAL SWITCH
1/16"
3/8"
7/8"
7/8"
WIRE TO POWER CIRCUIT
AERIAL WIRE
HARD RUBBER
6"
5"
3/4"
1/4"
1 1/4"
GROUND WIRE
X
K
F
3 1/2"
Y
Z
E
L
TO PRIMARY OF TUNER
TO SENDING SET
TO SENDING SET
8"
D
3 1/4"
7/8"
1"
4"
11 1/2"
2"
1"
2 1/4"
SENDING
SG
O
C
P
G
T
F
PS
F
A=AERIAL
G=GROUND P:
P-PRIMARY
S-SECONDARY
LS LIGHTENIN
OT OSCILLAT
T TRANSFOR
DS DETECTOR
AS=AERIAL
SG=SPARK G

binding post of the
on the upright with
nnect one secondary
e phone tips on the
ith one terminal of
second terminal of
l, or binding post of
double-pole switch
the diagram. This
e the strong nearby
stment of the detec-
a receiving station.
oor bell with two or
Then the contact
ected to the ground.
t will "squeal," that
ch noise. This can
the armature of the
contact, or by tying
very small. Follow
perienced.
of connecting the

o first. If batteries
wn is not necessary.
es with a telegraph
l will "buzz." Now
eces of wire to the
d stick them rather
If the key is pressed
wires. Connect the
ked "to the sending
he coil. The spark
e when sending. If

desired the battery circuit may be run thru the short blade of the aerial switch as in the diagram, so that when the switch is thrown to receiving the power of the coil will be cut off, thus avoiding accidental shocks. If a transformer is used for sending, a more complicated "hook up" will have to be used. Connect the power circuit thru a switch and fuse block, then run one side of the power circuit direct to one primary terminal of the transformer. Now connect the other primary terminal of the transformer with one terminal of the sending key, which by the way should have contacts heavy enough to break the current used by the transformer. Now connect the other side of the key to the power circuit thru the third blade of the aerial switch.

Connect the high tension condenser directly across the secondary terminals of the transformer. Be very careful in doing this to have the power switch pulled, for a shock from a transformer could be fatal. Now connect one clip on the primary of the oscillation transformer to one terminal of the condenser. Connect the other clip of the oscillation transformer primary to one side of the spark gap, the other side of the spark gap being connected with the other side of the condenser. These three connections should be as short as possible. Now connect one clip on the secondary of the oscillation transformer to one of the aerial switch clips marked "to sending set." The other secondary clip goes to the other clip marked "to sending set." It will be necessary to tune the set before best results can be obtained. Put about one middle turn of the oscillation transformer primary in the circuit. Put more or less turns in the secondary circuit of the oscillation transformer until the most current flows into the aerial. This can be indicated best by means of a hot wire ammeter or by use of an ordinary 110-volt lamp connected in the aerial circuit. When the lamp glows brightest the most current is being put out, and the set is tuned, approximately, at least. A license should be applied for,